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VOL 98 No 13 — ONE SHILLING

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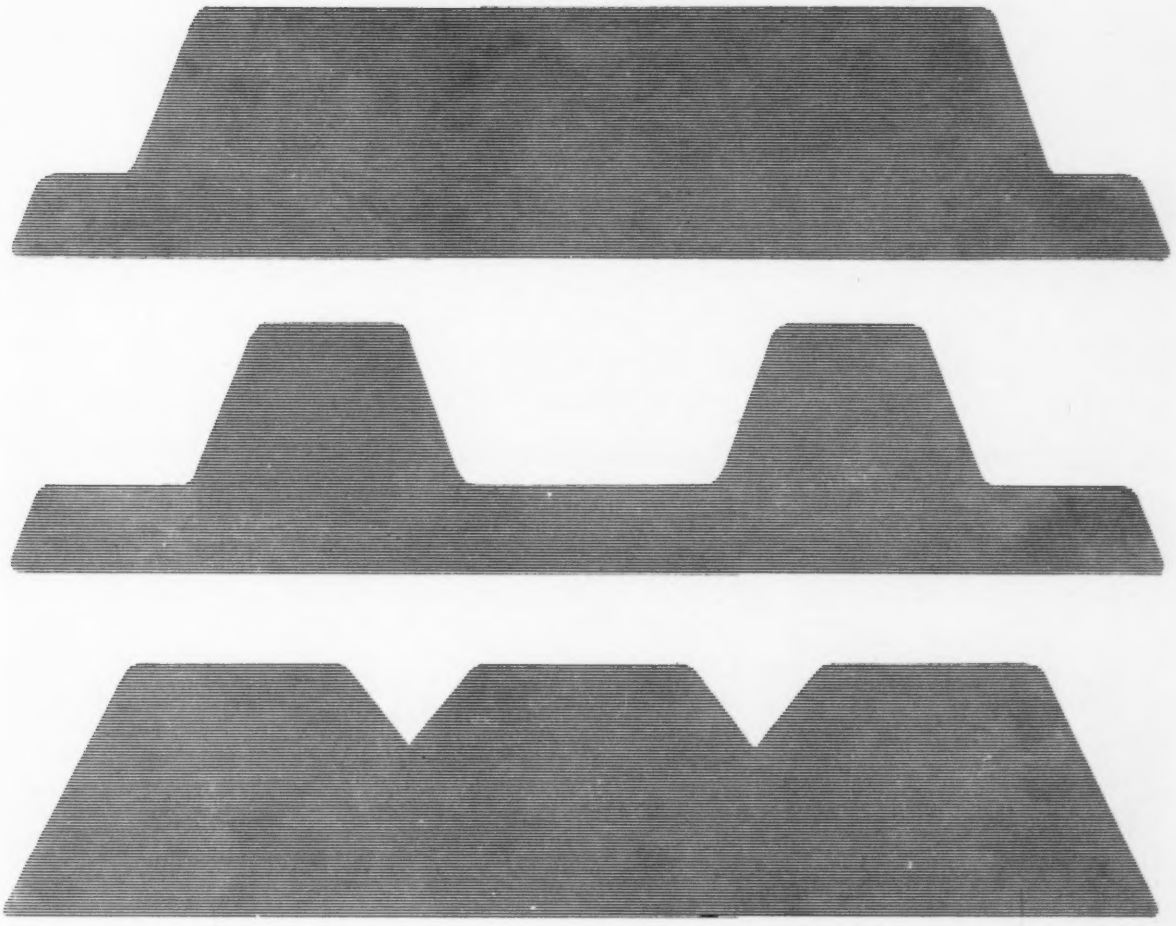

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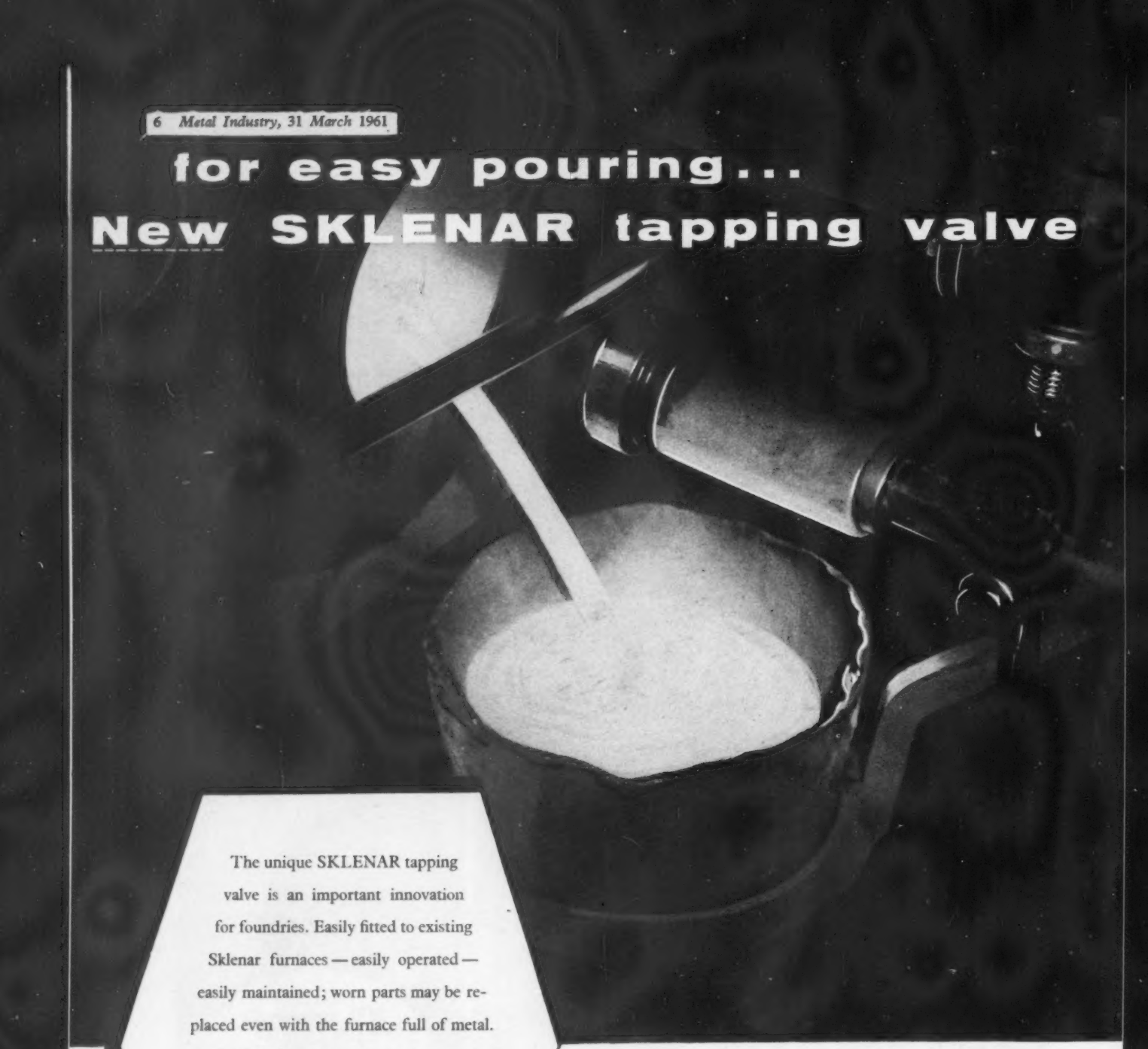

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METAL INDUSTRY

FOUNDED 1909

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METAL INDUSTRY

VOLUME 98 NUMBER 13 31 MARCH 1961

Lead and Zinc Supplies

NOTWITHSTANDING the fact that consumption of lead in 1960 reached record figures, there was still an estimated surplus of about 90,000 tons of supplies; in addition, there exists a substantial stock of unsold metal in the hands of the producers. Because of this, the International Lead-Zinc Study Group decided at the closing session of its third meeting in Mexico City to curtail lead supplies to a level of "approximately 2 per cent below estimated world consumption in 1961".

Specific action to reduce mine and ore metal production was announced by Australia, Mexico, Peru, Sweden, the United States, and countries of the European Economic Community. In addition to the action specifically taken, it should be noted that the Canadian lead industry had previously announced that it was taking steps to reduce its mine and metal production in 1961. Yugoslavia, too, signified its intention to reduce either its production or exports in 1961. To supplement these curtailments, and with the avowed intention of removing some of the accumulated stocks of lead now overshadowing the market, the United States announced its readiness to negotiate contracts for the barter of surplus lead stocks accumulated before December 31, 1960, against surplus agricultural commodities. These negotiations are scheduled for May 15 next.

In estimating supplies, the hope was expressed that lead exporters among centrally planned economies—principally the Soviet Union, Poland and Bulgaria —would not increase the level of their exports above those of 1960. It is gratifying to be able to record that representatives of the Soviet Union and Poland expressed their intention to co-operate with the other members of the Group. Unfortunately, however, they were not in a position to submit precise data. Because of this the figures of world production and consumption do not include centrally planned economies.

It is estimated that world consumption—excluding the Soviet bloc—will be approximately 3 per cent higher in 1961 than in 1960, while production, after curtailments, will be some 2 per cent lower this year than last. The Group expressed the hope that "countries other than those announcing the cutbacks would take no action that might nullify the effect of these curtailments".

No specific action was taken to reduce supplies of zinc. The situation differs from that of lead in that stocks in producers' hands are at record level, being about 3 per cent above those of 1959. A rise of approximately 4 per cent is expected in 1961. Little change is foreseen in the consumption of zinc this year. This expectation is based on the United States as a barometer, the business situation there being taken as indicative of the world situation.

At its meeting the Group also decided to "establish a special working group to examine the situation with regard to the two metals, including inter-Governmental commodity agreements". This special working group, comprising the representatives of eleven Governments, is to meet in New York before the end of June and one of its first tasks will be to cope with any possible future problems of over-supply. The fourth session of the main Group is provisionally scheduled to be held in Geneva in September or October this year.

Out of the MELTING POT

Reminder

IT is reasonably true to say that any scientific or technical phenomenon, however unusual, will sooner or later find some practical application. The very large number of phenomena available, which, moreover, is constantly being added to, makes it possible for a phenomenon occasionally to be overlooked and its application correspondingly delayed. In such cases occasional reminders are useful. One such overlooked and neglected phenomenon is electrolytic heating. The extent to which it has been neglected is shown by the fact that the mention of electrolytic heating is likely to conjure up quite a wrong picture of the phenomenon. In actual fact, the term refers to the heating of a metal connected as a cathode under suitable conditions in an electrolytic cell. The electrolytic heating depends on the use of a current density well beyond that at which the normal electrolytic processes take place. Given an appropriate current and voltage, the cathode becomes surrounded by a thick layer of minute bubbles which is retained as long as the current is left on. This layer offers a number of extremely high resistance paths to the current flowing in the electrolyte, and this leads to rapid heating of the metal forming the cathode. At the same time, this layer acts as a heat insulator around the cathode, with the result that very little of the heat generated is lost by the cathode to the electrolyte while the current is on. The electrolyte thus remains comparatively cool, while the cathode is heated to relatively high temperatures, e.g. 500°C. Such temperatures, moreover, are attained extremely rapidly—in a matter of seconds. A temperature of 500°C. is obtained, for example, when an iron rod 10 mm. in diameter is immersed to a depth of 5 mm. in a 28 per cent solution of sodium carbonate and 220 V are applied, causing a current of 20 amps to flow through the electrolyte. A reminder about the existence of electrolytic heating is provided by a recent patent which claims it as a means of heating metals, with the advantages of rapid uniform heating regardless of the shape of the part and its surface finish, and adaptability to continuous heating, e.g. of wire. Without considering the patent aspects of this reminder, the need for it is suggested by the fact that among the references to relevant prior publications cited in connection with this patent are two American, one British and one Swiss patent, all dating back to before 1900, and a reference to something published in the literature on June 10, 1893.

Temporary

EVEN a collection of substantially similar pronouncements by a number of undoubted authorities cannot be regarded, to begin with, as indicating more than a passing phase. The purer research workers should, therefore, not allow themselves to be frightened by a recent outburst on the other side of the Atlantic to the effect that a closer look should be taken at industrial research and development activities, and a tougher line be taken in regard to the relation between what they cost and what they yield. Forgetting, for the moment at any rate, all that has been said and written about the difficulties of assessing the returns on money spent on research, it has now been stated quite bluntly that an expenditure of *x* dollars should have resulted in the emergence of half-a-dozen new products. Equally blunt enquiries should, it has been suggested, concern themselves with the number of Papers and patents originating from the laboratory; with (somewhat inconsequentially) the proportion of time spent on paper work, with the apportioning of time between work towards the improvement of existing processes and products and the devising of new ones, and similar leading questions. Such an outburst will hardly pass without repercussions. Accountants, statisticians and the like will be moved to action, computers will be programmed, figures will be produced, examined and discussed. Steps may be taken . . . The outburst will, however, hardly pass without reactions. Once again the value of fundamental research will be pointed out. Once again the need for a psychologically congenial atmosphere, if research workers are to give of their best, will be emphasized. Above all, reality will take effect to bring this passing phase to a close and return research and development activities to their highly successful, even though unassessable, methods and pursuits.

Look-in

DESPITE the interest being shown in intermetallic compounds in connection with the semiconducting properties of some of them, the average metallurgist is still inclined to regard them with a somewhat jaundiced eye. This attitude originated, of course, in the past, when, with a few exceptions, compositions corresponding to definite intermetallic phases, because of their properties, were dismissed as useless for the engineering applications at which metallurgists developing alloys were aiming. More recently, this attitude has been perpetuated by the flood of electronics jargon which the mere mention of semiconducting intermetallic compounds is always liable to release. Under its impact, an intermetallic compound is quickly converted into a well-nigh disembodied conglomerate of carriers, barriers, forbidden zones and such-like concepts in which no true metallurgist could continue to take any real interest. It seems a pity that the above attitude has been allowed to obscure the fact that there still remain opportunities for simpler basic exploratory work of an eminently metallurgical nature. Much of it, in fact, is reminiscent of the early work on the trial-and-error development of alloys for engineering purposes. Intermetallic phases need not, indeed, be the final answer in all cases. Their properties can often be further modified in various ways by further alloying. Thus, the intermetallic zinc-antimony compound (SbZn, with 35 per cent by weight Zn and 65 per cent Sb)—the classic material for the elements of thermoelectric generators — can be improved in respect of its thermoelectric properties and electrical conductivity. The influence of numerous small alloying additions has been and is still being studied. Some elements, like copper and silver, increase the electrical conductivity but reduce the thermoelectric properties. Some, like cadmium and silicon, increase the thermoelectric properties but reduce conductivity. Some, like indium, aluminium, tellurium and iron, have little or no effect. A few, like tin and bismuth, raise both the thermoelectric properties and the conductivity. Then there are the quaternary alloys. There are also the microstructural and X-ray investigations of such alloys—plenty of metallurgical work before the electronics boys take over.

Skimmer

MELTING AND CASTING FOR VARIOUS PARTS IN REACTIVE METALS

Titanium Casting Technology

By S. L. AUSMUS, F. W. WOOD and R. A. BEALL

(*Continued from* METAL INDUSTRY, 24 *March* 1961)

CAST tubes of reactive metals have been produced by centrifugal casting using conventional practice. Fig. 10 is a picture of the inside of the furnace shown in Fig. 1. The spin-casting apparatus consists of a duplicate set of three spindles: the top one is spring loaded, driven by a jacksnaft and cnain; the shaft passes through a vacuum gland in the furnace wall. Molten metal is poured into a graphite cylindrical mould backed by a steel pipe. Hardened steel rings, which match the trunnion wheels and prevent lateral drifting, are mounted on the exterior of the pipe. The ends of the casting mould are also graphite with steel backing. The trunnions are mounted so that their spacing can be adjusted to fit moulds 4 to 18 in. in diameter, and the chain drive permits lateral adjustment.

In operation, the metal was poured through a large funnel into a vertically placed graphite tube. The metal flowed into the mould through a 1½ in. diameter sprue. Speeds of 400 to 1,200 r.p.m. have been used, resulting in centrifugal forces of the order of 70 to 100 *G*. Fig. 11 shows some of the castings produced from a titanium alloy, and one of the moulds dismantled.

The apparent surface contamination due to graphite is very slight. This suggests again that the metal was in contact with the mould walls for only a short time before it froze and shrank away. Of interest, was the relatively fine-grain structure of these castings, compared with the large grains in the conventional cold-mould ingot. The surface finish on the interior was usually of excellent quality, except in instances where very short castings were made. It is presumed that this roughness was due to excessive turbulence during pouring.

Originally, porosity was evident in some castings. This has been eliminated to a large extent by the use of good-grade melting stock and by more careful control of energy input. As an example of the soundness obtained, two cylindrical castings of hafnium, 12 in. long by 1½ in. I.D. by 2¾ in. O.D., were gamma-graphed by another agency, which reported an area of sponginess near the end of one casting and a few spots of porosity near the exterior surface, the largest being about 1/16 in. in diameter.

In commercial extrusion practice, zirconium and titanium arc-melted ingots must be forged to break up the gross grain structure. For tube production, then, sponge must be double melted, conditioned, forged, conditioned, and bored or pierced. As an alternative, the proposal was to double melt, spin cast, and machine to final size, eliminating two steps and improving the yield. Another advantage can be realized when the cost of drilling or boring becomes prohibitive because of hardness of the alloy.

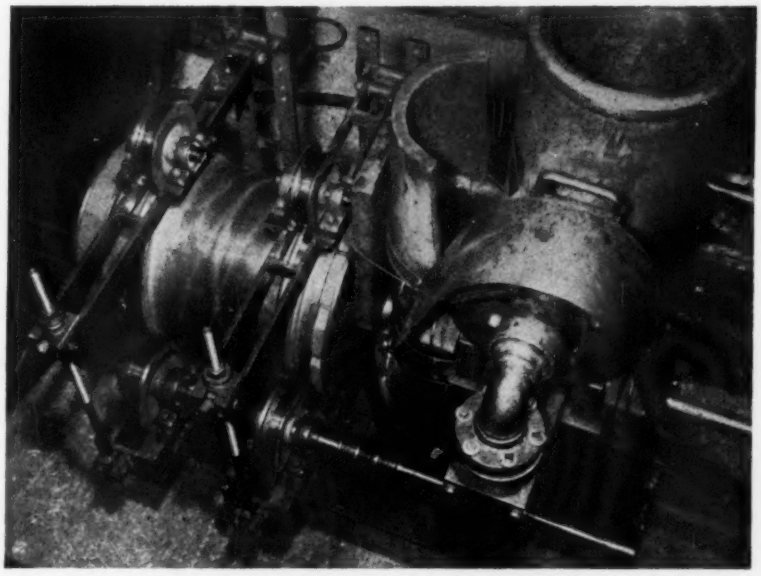


Fig. 10—Spin casting mechanism, showing crucible and pouring funnel on right

Three Zircaloy-2 blanks were produced during 1957 and shipped to Chase Brass and Copper Co. for extrusion. All outside surfaces of one tube were left in the as-cast condition; the surfaces of the remaining two tubes were conditioned by machining.

From original dimensions of 6·73 in. O.D. by 1·82 in. I.D. by approximately 9 in., each blank was successfully extruded to tubes of 2 1/16 in. O.D. by

Fig. 11—Typical centrifugal castings of titanium produced in mould on right

1¾ in. I.D. by about 17 ft. long. Results for the blank with as-cast surfaces were particularly pleasing, perhaps because an inferior product was anticipated. Actually, all tubes produced appeared to be satisfactory, and only a relatively light finish grinding was required. Fig. 12 shows the tubes with part of each still in the as-extruded condition and the remainder as-ground. Table I shows the material yield.

Extrusion was followed by a group of bench-drawing and stretch-straightening tests. The results of the tests may be summarized as follows:—

Centrifugally-cast blanks of Zircaloy-2 can be successfully extruded directly from the as-cast state without intermediate conditioning other than light machining of surfaces.

The outside surfaces of extruded tubes are commensurate with the surface finish of the starting blanks, but otherwise are normal for Zircaloy-2.

Extrusion without prior machining of cast surfaces results in unexplained surface stringers, but is otherwise satisfactory.

The inside surfaces of extruded tubes are somewhat rougher than normally expected for Zircaloy-2 but are still acceptable.

Extrusion can be followed by bench drawing to achieve additional reduction in area up to a total of at least 25 per cent in about 10 or 15 per cent increments. Vacuum annealing, recoating, and maintenance of small plug clearances may permit reductions in area by drawing up to a total of about 50 per cent, but this possibility must be tested further.

Relatively slight stretching of extruded Zircaloy-2 tubes results in a significant increase of 0·2 per cent offset yield strength without comparable changes of other tensile properties.

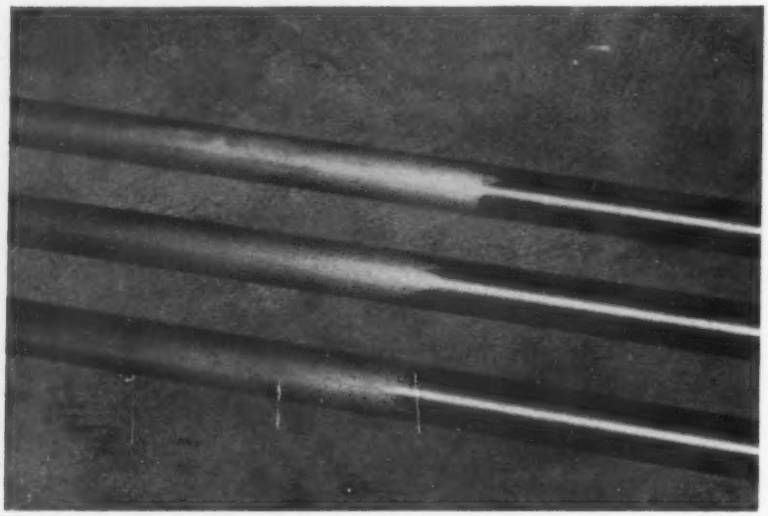
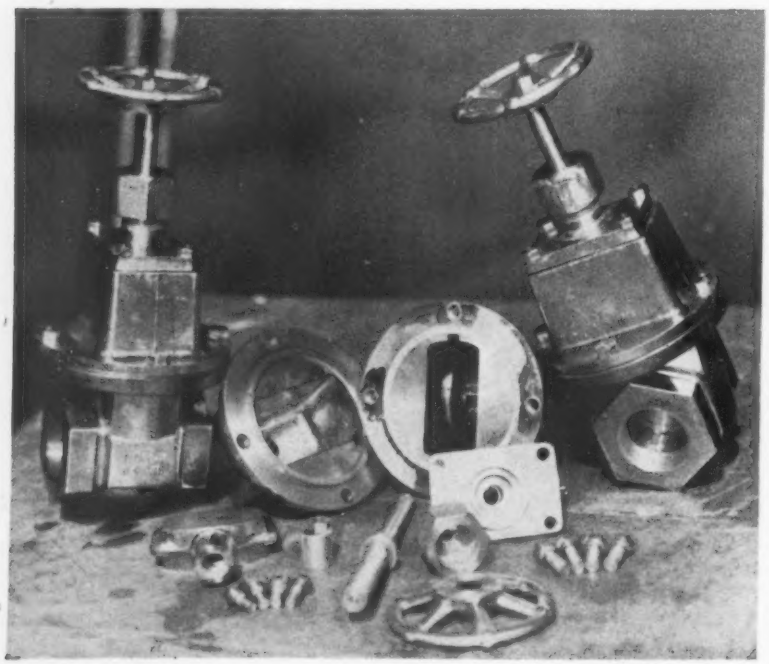


Fig. 12—Titanium tubes extruded directly from as-cast billet, showing original surface and ground finish

Fig. 13—Cast titanium gate valves



Physical Properties

In October, 1957, a series of the gate valves shown in Fig. 13 was placed in industrial service to establish performance characteristics when subjected to (a) water containing 2,300 p.p.m. chloride at 284°F. (140°C.), (b) 65 per cent nitric acid at 230°F. (110°C.), (c) 15 to 16 per cent sodium hypochlorite at 194°F. (90°C.). The same valves were hydraulically tested, and all seats and gasket seals withstood at least 500 lb/in^2 of sustained pressure. This was the upper limit of the hydraulic testing equipment. After 1 yr. of operation as specified above, the valves appear to be unchanged.

A group of 25 Zircaloy-2 brackets of the type shown in Fig. 8 was fairly typical of static castings produced in machined graphite moulds. A discussion of their properties will be used to illustrate the normal quality to be expected in reactive metal castings. Surfaces were generally smooth, but there were occasional superficial folds or wrinkles caused by the high rate of heat loss to the graphite mould. The surfaces ranged from bright to light shades of tan or grey. Metallography of surface sections revealed that carbon contamination extended to a maximum depth of 20 mils (0·020 in.). Analysis of samples collected from the first 5 mils under the surface indicated 400 to 600 p.p.m. carbon, and analysis of samples from the entire 20 mils of surface contamination indicated 200 to 400 p.p.m. carbon. Above 500 p.p.m., carbon contamination causes a slight increase in the corrosion rate of zirconium in chloride solutions, but this increase does not become serious until the contamination level exceeds 1,000 p.p.m.[6]

Internally, the bracket castings contained scattered porosity, mostly pinhole variety; but in a few instances porosity approached ⅛ in. The soundness was adequate for normal corrosion service but would fail to meet the usual aircraft-type specifications. However, there is no reason to believe that aircraft quality could not be obtained through the improved design of static moulds or by resorting to centrifugal casting techniques.

Several brackets were subjected in their entirety to corrosion by steam at 750°F. and 1,500 lb/in^2 for three days.

TABLE I—MATERIAL-YIELD DATA ON EXTRUSION

Casting No.	Extrusion No.	Rough to finished blank, per cent	Finished blank to half-conditioned tube per cent	Overall yield per cent
SA 16, 929	390	92·5	88·8	82·2
SA 17, 159	391	86·3	88·5	76·3
SA 17, 171	392	87·0	86·3	75·1

TABLE II—CORROSION RATES OF CAST AND WROUGHT ZIRCALOY

Time, days	Weight gain, mg/cm²	
	Average of cast brackets	Typical of wrought metal
14	2·80	3·5
28	3·97	4·5
42	4·50	5·5
56	6·22	6·5
70	6·84	7·5
84	8·07	8·5
98	9·39	9·5

The result was a normal lustrous black oxide layer. No white corrosion products were formed. Standard corrosion coupons were also collected and subjected to 750°F. steam at 1,500 lb/in² for a total of 98 days. The results are compared in Table II with typical behaviour of wrought metal.

The average 0·2 per cent yield strength was 49,600 lb/in², average tensile strength 66,600 lb/in², and reduction in area at the fracture averaged 36 per cent. These values are typical of hot-rolled metal of the same composition. The thin wall sections of the cast brackets necessitated a sub-standard Charpy V-notch test, and a special series of specimens from wrought metal was tested for comparison. The cast specimens possessed about one-half (6 ft-lb.) the impact resistance of wrought metal (10 ft-lb.) both at room temperature and at 200°F.

Reference

[6] L. B. Golden, I. R. Lane, Jr. and W. L. Acherman; *Ind. Eng. Chem.*, 1953, 45, 4, 782.

(To be concluded)

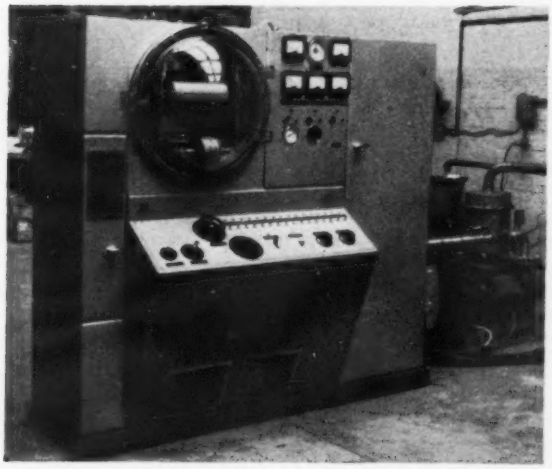
Continuous Vacuum Metallizing

DESIGNED as a self-contained unit, the latest version of the V.M.D. 12 in. continuous vacuum metallizer is ready for operation after connecting up the mechanical vacuum pump and power, air and water services.

Most materials in roll form can be processed at speeds up to 1,200 ft/min., although for thick coatings a speed of 800 ft/min. is preferred. Materials which have been successfully treated include vegetable parchment, G.I.P., friction glazed paper, glassine, cellophane, cellulose acetate, polyester and P.V.C. films, pliofilm and most coated packaging materials.

In this machine, a product of Vacuum Metallurgical Developments Ltd., Shelford, Cambridge, the material is mounted in the form of rolls 12 in. diameter by 12 in. wide. The vacuum chamber is then closed and pumped down in a period of about 2 min. The web passes over a heated continuous evaporation source and is then rewound in the main chamber of the machine. Air is admitted in less than a minute after coating. The finished roll is removed and the cycle repeated. A production of more than 25,000 linear ft/hr. of material can be readily attained. This equipment has been designed specifically with the needs of the capacitor market in mind. In one single operation, plastics film or capacitor tissue can be metallized and provided with a blank margin, and then slit and rewound on to bobbins suitable for the direct winding of capacitors.

Although metallized film has until recently been used only for specialized capacitors, this new process is economic as compared with the use of aluminium foil for the manufacture of a wide range of larger capacitors for general use in the electrical and electronics industries.



The V.M.D. 12 in. self-contained vacuum metallizing plant

Oxygen Determinations

A BATTERY-OPERATED device, which can be regarded as an alternative to the Orsat apparatus for determination of oxygen anywhere in the range 0-100 per cent to an accuracy of ±0·1 per cent, has been developed by Servomex Controls Limited, Chemical Instrument Division, Crowborough, Sussex. Operation is simple, and as the device is linear, calibration at two points is sufficient to standardize over the whole scale. The zero is highly stable, and a check of the span, using air as a test gas, is sufficient for most normal uses.

This type DCL 101 portable analyser may be used with static samples or with a continuously flowing sample at rates up to 150 mL/min. The sample must be filtered and cooled sufficiently to remove condensate, but there are otherwise few restrictions. The measuring cell is particularly tolerant of variation of sample components other than oxygen, and it is not in any way affected by thermal conductivity or density variations.

Experience with the industrial analyser has shown that the DCL measuring cell is extremely robust. It contains a very light dumb-bell shaped test body suspended by a platinum ribbon in a non-uniform magnetic field. The torque on the test body produced by the presence of oxygen in the measuring cell is balanced by passing current through a coil wound on the dumb-bell. The balance condition is observed by means of a light spot reflected on to a scale and is obtained by adjusting a calibrated source potentiometer. The read-out is taken direct from a linearly calibrated ten-turn dial.

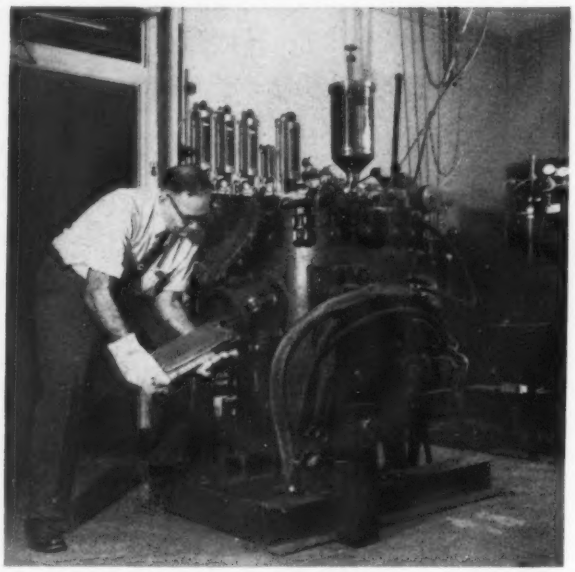
The DCL 101 portable oxygen analyser is used for routine oxygen determination and can be made ready for use within seconds. It is 13 in. in length, 8¼ in. in width and 9½ in. high and weighs only 18 lb.

GAS-FREE INGOTS FROM SINTERED MATERIAL MELTED UNDER DRY HYDROGEN

High-Purity Nickel

ATTEMPTS to prepare high-purity nickel often result in "gassy" ingots—the ingots contain numerous bubbles produced by the evolution of gases during solidification of the casting. This difficulty can be overcome by the addition of de-oxidizing or degasifying elements such as magnesium, manganese, silicon or carbon, but this method, of course, adds to the impurity content. Contamination may also take place from the crucible during melting, and during subsequent fabrication of the ingot.

Methods of overcoming these difficulties have been devised by Bell Telephone Laboratories, New York. In a study of the electron emission of oxide-coated nickel-based cathodes, a method was devised for preparing the high-purity metal so that the effect on cathode emission of making controlled additions of "impurity" elements to the nickel base could be determined. The method can produce nickel with no single impurity present in amount exceeding 50 p.p.m.



Removing a 1½ in. thick high-purity nickel ingot from the controlled atmosphere furnace

Powdered metal produced by the International Nickel Co. (Mond) Ltd. was selected as the purest starting material commercially available. This showed on analysis 0·2 per cent oxygen, 0·07 per cent carbon, 0·0004 per cent iron, and all other impurities at 0·001 per cent or less.

The process consists of melting down sintered slugs in dry hydrogen in a controlled-atmosphere furnace. A crucible of magnesium oxide is used, and heating is effected by an induction coil operating at a frequency of 1920 cycles/sec. No additives are necessary in the process. The nickel powder is sintered to form slugs by treatment in wet hydrogen at 800°C. for 16 hr.; this reduces the oxygen content and causes the carbon content to drop from 0·07 per cent to 0·007 per cent.

Melting takes place in a steady flow of dry hydrogen at 20 ft³/hr.; 10 min. is allowed for the melt to reach a stable temperature of about 1,500°C. The hydrogen is then purged with dry helium, and all gases are subsequently removed by evacuation. A further reduction of residual carbon and oxygen is effected by the re-admission of dry hydrogen for 15 min., followed again by helium purging and evacuation. Finally, helium is re-introduced at a pressure of 1 atmosphere and flow-rate of 20 ft³/hr.

The molten metal is poured into an alundum-coated steel mould, producing ingots 1½ in. thick and weighing 26 lb. The ingots are hot-rolled in air at 1,000°C. to a thickness of 0·5 in., and are then machined to remove the oxide scale. Cold-rolling reduces the thickness to 0·08 in., and the strip is then annealed in hydrogen at 800°C. Further cold-rolling and annealing reduces the thickness to 0·020 in. and finally to 0·003 in.

Careful control is needed to prevent contamination during fabrication of the ingot. Annealing is performed in a clean Inconel tube, and special rolls are reserved for reduction of the strip. Pure kerosene is used as a lubricant during rolling; this lubricant and other surface contaminants are carefully removed before each anneal.

The addition of controlled amounts of impurity elements can, if desired, be made to the melt prior to casting. Trials on cathodes based on nickel prepared in this way have been conducted by the Bell Laboratories, and promising results were obtained with metal containing 2 per cent of tungsten with or without small additions of magnesium. This research has been especially useful in the development of new submarine-cable vacuum tubes.

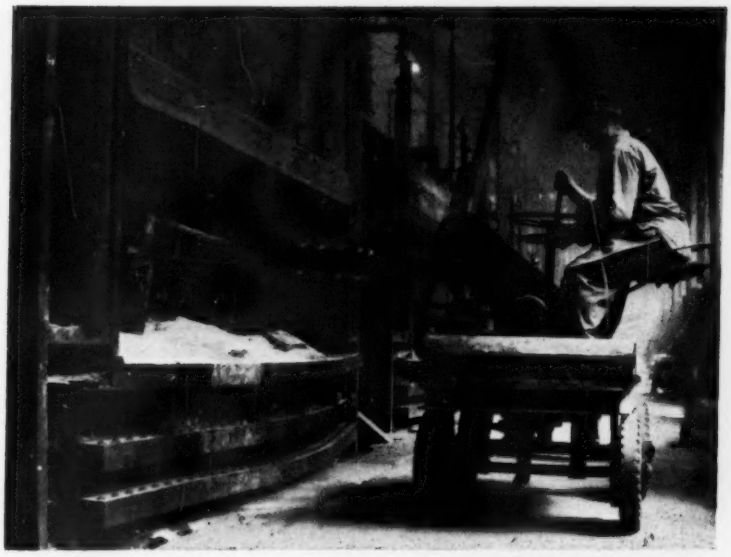
A development programme for large-scale production of high-purity cathode material has been arranged with the Metals Manufacturing Division of the Western Electric Company, at Hawthorne, Illinois.

Success in this study has resulted from the availability of the high-purity metal, so that a systematic survey of the effect of controlled impurity additions could be made. Similar successes in other applications will, no doubt, follow now that the problems of producing satisfactory high-purity ingots have been solved.

Plated Aluminium

IN tests designed to determine the atmospheric corrosion resistance of nickel-chromium plated aluminium alloy sheet, panels of 3S alloy sheet, plated with bright chrome (copper-nickel-chromium) by the zincate, Vogt and phosphoric acid anodizing pre-plating processes were exposed outdoors in semi-rural and severe industrial atmospheres for up to two years. Good performance, particularly in freedom from blistering or flaking, was shown by panels treated by phosphoric acid anodizing, although minimum nickel thicknesses were only ⩽0·001 in. The panels processed by the zincate and Vogt techniques with nickel thicknesses <0·0015 in. failed within one year of industrial exposure, due to severe blistering. Improved weather resistance was shown by panels plated by all three procedures as the nickel thickness was increased. Panels for severe industrial exposure conditions required ⩾0·0015 in. nickel. Plating a nickel coating direct on the phosphoric acid anodized films would eliminate an objectionable staining. Use of phosphoric acid anodized plate on other aluminium alloys is suggested. The combination of phosphoric acid anodizing with deposits in adequate thicknesses of recently developed types of chromium and nickel should show superior outdoor exposure performance. The work, reported in *Metal Finishing*, was carried out by Aluminium Laboratories Ltd. (Canada).

Hungarian Aluminium Industry



Alumina being "broken-in" for electrolysis in the No. 3 hall at the Tatabánya foundry

BASED on the substantial assets in bauxite, found notably in the county of Veszprém, the Hungarian aluminium industry has been in existence some 25 years. The recent uncovering of reserves by systematic prospecting promises that the industry's requirements will be covered for several decades to come.

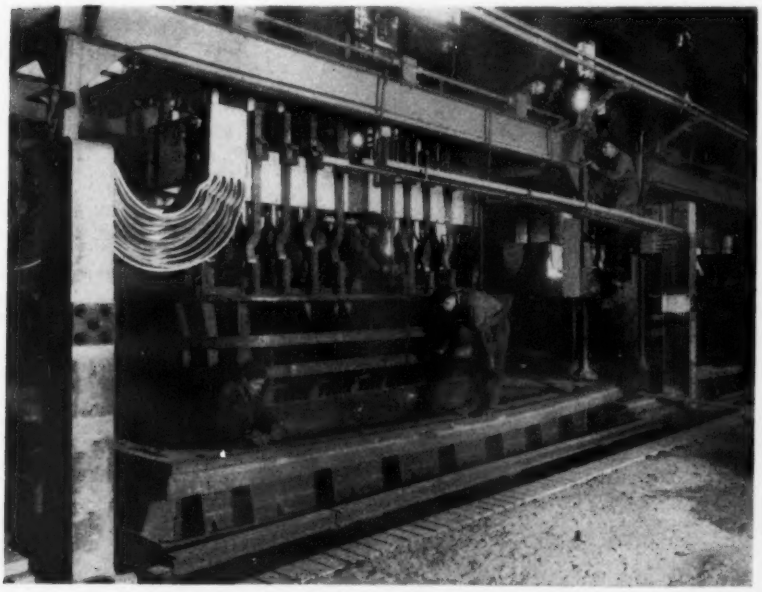
Extraction of bauxite last year totalled 1,188,519 tons. This ranks Hungary second in Europe and sixth in the world. Though a number of mines have been worked out in the last few years, the opening up of new ones more than keeps pace with demands, and it is expected that by the end of 1965 annual output will be up to 1,600,000 tons.

Roughly one-third of current production of Hungarian bauxite is exported —most of it to Czechoslovakia and some to East Germany and Poland.

As a result of expansion of the alumina plants at Ajka and Magyarovár, production of alumina last year exceeded 218,000 tons, which is more than seven times the 1949 figure and more than 30 times what it was pre-war. At the present rate of progress, the industry should have no difficulty in reaching the target of 260,000 tons planned for 1965.

Alumina output is more than enough for the furnace capacity of the country's aluminium foundries, so Hungary has built up a lively export trade. Just over half the output was exported last year (121,154 tons). Most alumina exports go to neighbouring countries.

One of the extraction cells in the new smelter at Tatabánya



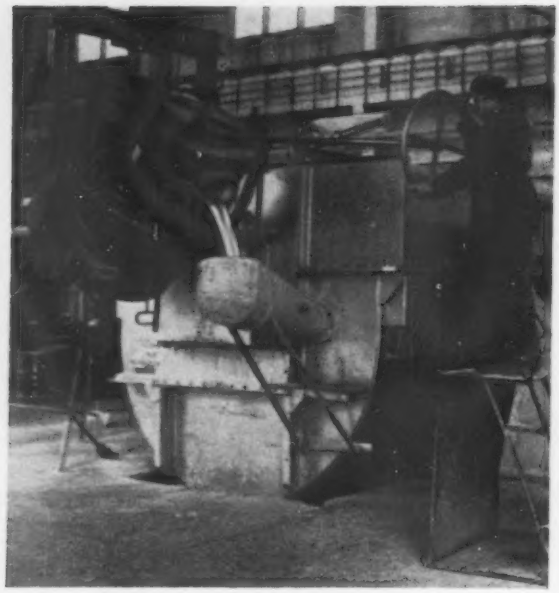
Despite the fact that considerable quantities of alumina are exported, the aluminium smelters have a good record of expansion over the last few years. Last year, aluminium output was 49,534 tons, which was more than three times the 1949 figure. Pre-war output was negligible (1,300 tons). About a quarter of last year's output was exported (11,188 tons).

A measure of the efficiency of the extraction side is the consumption of electric power per ton. Present consumption of d.c. power averages a little below 17,000 kWh/ton, which may be considered satisfactory by international standards. The more modern Ajka plant has attained 16,300 kWh/ton, which is equal to the figures recorded by Russian plants.

Nevertheless, the substantial power demand is a heavy drain on national power resources, particularly at a time when industry is expanding in every direction.

The aluminium industry at present consumes about 12 per cent of the national power production. It is for this reason that new investments for the development of aluminium metallurgy have been omitted from the next Five Year Plan. The accent will be on cheaper and greater production in existing plants. The No. 3 plant at Tatabánya, out of use for many years, has been put into operation again.

Leaders of the industry are inclined to the long-term view that it would pay to export more alumina and to import aluminium ingot from the countries where power is cheap and to process the metal in Hungarian mills. Thus,



Above—Charging molten metal at the Inota foundry

Right—Ingot casting at the Ajka plant in Western Hungary

in finished and semi-finished products, the cost falling to electric energy would be lower than if the aluminium were extracted in Hungary.

For this reason, a high-output aluminium forging plant is now under construction at Székesfehérvár and should be completed by 1962. This will be followed by the erection of a new aluminium rolling mill in the same city, scheduled for completion by 1968.

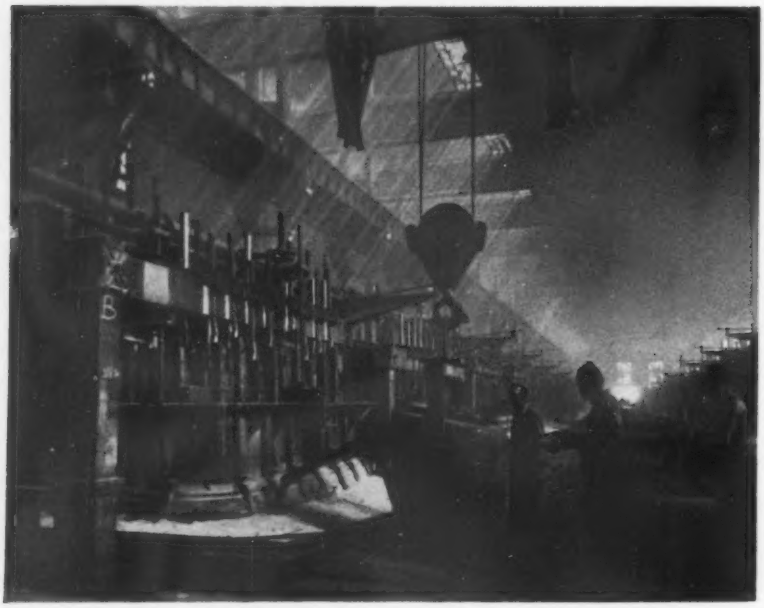
The Székesfehérvár plant will also be equipped for the production of modern semi-finished and finished products of aluminium alloys.

Existing rolling mills are already producing semi-finished products of 99·9 per cent purity, and various factories are turning out aluminium products for the electric and building industries, and high tensile elements for the wagon, cable and shipbuilding industries.

Every encouragement is being given to increased home consumption of finished aluminium products, which has risen tenfold in the past ten years.

Moves began three or four years ago to reclaim valuable materials from the acres of red mud around the old alumina works. This red mud contains up to 40 per cent iron, and some vanadium and gallium. A new extraction plant was completed at the Almafúzitó alumina works in 1958. At Ajka, a test plant is extracting gallium.

Pumping molten aluminium from the cells through steel pipes into the ladle



INVESTIGATION INTO FACTORS AFFECTING CHARACTERISTICS OF COATINGS

Flame-Sprayed Alumina

IN order to determine the factors affecting flame-sprayed alumina coatings, an investigation has been undertaken by the American National Bureau of Standards. The work to date has demonstrated the influence of the temperature and velocity of particles in the spray on the characteristics of the resulting specimen as well as their cooling rate following impact. Since one of the determinants of coating structure is particle velocity, a rotating-disc velocimeter was specially developed to measure this variable. Experiments on bonding suggest that the bond between coating and metal is largely mechanical in nature.

Of the three current methods for applying coatings to metal by particle impact, namely, flame-spray, detonation, and plasma-jet, the flame-spray technique offers the advantages of mobility and relative ease of operation.

In flame-spraying alumina, two types of oxy-acetylene guns are used to melt and propel the particles. In the powder method, finely divided alumina is fed into the combustion zone, producing a continuous stream of particles. The rod gun is fed by a $\frac{1}{8}$ in. rod of sintered alumina, and air is introduced at the exit nozzle to increase particle acceleration. It was observed that the rod gun normally produces bursts of particles, rather than a continuous stream.

Experiments have shown that the strength of the bond formed between alumina and iron increases exponentially with increase in surface roughness of the substrate. In order to measure bond strengths, metal strips were roughened to various degrees by different blasting treatments and mounted between two knife edges so that a 0·05 in. length of each strip projected beyond the tips. Both sides of this projecting portion were spray-coated to a thickness of 0·010 in. ±0·002 in. The force required to shear the coating from the strip was then determined by pulling the coated section through the gap between the knife edges. The sprayed particles of alumina did not adhere to metal strips that had been polished. The measured bond strengths for surfaces that had undergone severe roughening were many times greater than for surfaces that had received only mild roughening treatment. Also, bond strengths for coatings formed with the rod gun were greater than for those formed with the powder gun.

Disc Velocimeter

The rotating disc velocimeter specially developed for determination of particle velocities consists of a 16 in. metal disc, with a narrow metal strip attached by means of posts which support it at a known distance from the surface of the disc. A glass slide is attached to the disc in a position where it will be partially shielded from the sprayed particles by the narrow metal strip. When this slide is sprayed with the molten alumina, the strip creates a "shadow" in the layer of particles that adhere to the slide. The slide is first sprayed while the disc is at rest, and then when it is rotating at known speed. The displacement between the two "shadows" formed on the slide is a function of the particle velocity. The particles from the rod gun had a measured peak velocity of 566 ft/sec., and those from the powder gun, 145 ft/sec.

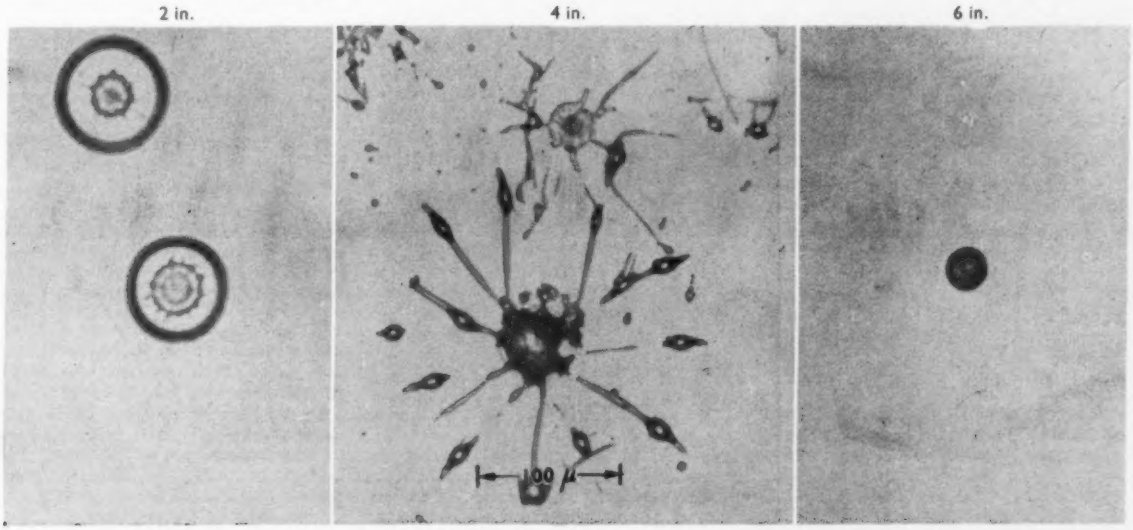
While no direct method was devised for determining the temperature of the small, fast-moving particles, the appearance of the particles after impact gave an indication of their consistency at the instant of contact. Glass slides were sprayed while maintained at various distances from the guns, and the particles that adhered were examined microscopically.

From the patterns produced by the particles when they deformed upon impact, it was determined that at 2 in. from the powder gun most of the particles were molten only on the outside; at 4 in. practically all the droplets were completely molten; and at 6 in. only the cores were molten. Particles that were completely molten at the time of impact adhered more readily than the others. The rod-gun particles, because of their higher velocity, flowed more on impact than did the powder-gun particles.

Cooling Characteristics

The thermal properties of a material influence the flow of molten particles immediately following impact. When the adhering particles cool more slowly, as they do on glass, flow continues for a longer time than when the cooling rate is very rapid, as it is on platinum. Cooling rates were calculated for a thin layer of molten alumina striking the surfaces of various materials at

The appearance of alumina particles collected at various distances from the flame-spray guns is an indication of their condition at the time of impact. The particles shown at left were molten only on the outside, those in the centre were completely molten, and the particle on the right had a molten core surrounded by a solid envelope



room temperature. The initial cooling rate of molten alumina on glass (2,050°-1,800°C.) was computed to be 34,000°C/sec., and on stainless steel, 800,000°C/sec.

Experiments with heated platinum substrates indicated that the ratio of alpha and eta or gamma alumina in solidified particles is dependent upon the quenching rate, and that the formation of the metastable eta form is favoured by rapid quenching.

When a particle strikes glass it cools less rapidly than when it strikes metal, thus allowing more time for a chemical bond to form. To indicate whether slower cooling would also give a chemical bond with metal, augmenting the mechanical bond, a strip of iron was coated with porcelain enamel, which, in turn, was covered with a 0·0003 in. layer of nickel. The ceramic substrate effectively lowered the cooling rate of the sprayed particles, but the bonding showed no improvement.

On glass, good bonding occurred whether the surface was rough or smooth, but on iron the bond strength was substantially increased by roughening the surface. These results suggested that the bond between the alumina coating and glass substrate is largely chemical, but that the bond formed between flame-sprayed alumina and metals is principally mechanical in nature.

Men and Metals

After 19 years as chairman of Coley Metals Limited, **Mr. R. J. Coley** has retired and has accepted the office of President of the company and will still remain a director. He is succeeded as chairman by **Mr. R. W. Coley.**

Consequent upon the appointment of **Dr. Richard Beeching** as chairman of the board of British Railways, Imperial Chemical Industries Limited have made the following appointments: **Mr. Harold Smith** (chairman of the General Chemicals Division) to be technical director of the company; **Mr. M. J. S. Clapham,** at present chairman of the Metals Division, to be an overseas director in place of **Dr. J. S. Gourlay,** who is to be group director, Alkali and General Chemicals.

At the Council meeting of the Iron and Steel Institute, held recently, the following were elected honorary Vice-Presidents of the Institute: **Dr. Mont Howard Biers,** M.Sc., F.I.M., senior consultant of the Union Carbide International Company, and **Dr. T. P. Colclough,** C.B.E., D.Met., D.Sc., F.R.I.C., F.I.M., technical adviser, British Iron and Steel Federation.

At the same meeting, the Council of the Iron and Steel Institute announced the award of the following medals and prizes: Bessemer Gold Medal for 1961 to **Mr. William Barr,** O.B.E., director and chief metallurgist, Colvilles Limited; the Sir Robert Hadfield Medal for 1961 to **Mr. Emrys Davies,** managing director, Brymbo Steel Works; the Williams Prizes for 1960 (£50 each) to **Mr. T. McHugh** and **Mr. F. A. Kirk** (Low Moor Fine Steels Limited).

It has been announced by British Insulated Callender's Cables Limited that **Mr. V. J. Ross,** A.M.I.E.E., has been appointed assistant regional manager, Scotland. Mr. Ross was formerly sales manager for Scotland of Scottish Cables Limited, a wholly-owned subsidiary of BICC.

The board of the newly-formed company, Engineering Laboratory Equipment Limited, comprises the following: **Mr. M. W. Leonard,** B.Sc. (Eng.), M.I.C.E., A.M.I.Mech.E., **Mr. A. C. Meigh,** M.Sc., A.M.I.C.E., **Mr. F. A. Renn, Mr. H. C. Mayer,** F.A.C.C.A., and **Dr. D. S. Beard,** Ph.D., A.Inst.P., A.R.C.S.

At the annual general meeting of the Non-Ferrous Club, held in Birmingham last week, the following members were elected to the five vacant places on the committee: **Mr. A. H. Bradley** (McKechnie Bros. Ltd.), **Mr. D. Gibbs** (A. D. Keeling and Co. Ltd.), **Mr. K. B. Morley** (United Non-Ferrous Metals Ltd.), **Mr. B. Roberts** (M. Joseph and Son (Birmingham) Ltd.), and **Mr. A. E. Teasdale** (Martins Bank Ltd.).

Managing director of Henry Wiggin and Company Limited, **Mr. H. W. G. Hignett** has been appointed a director of the International Nickel Company (Mond) Limited. **Mr. Jean M. Dhavernas** has also been appointed a director of the latter company. He is located in Paris and has been closely concerned with the nickel markets on the Continent for many years.

It is announced that **Mr. H. J. Penn** has been appointed chairman of Murex Limited and of Murex Welding Processes, and that **Mr. F. W. Tomlinson** is to be deputy chairman of both companies. **Mr. H. C. Green** has been appointed managing director of Murex Limited, and **Mr. J. M. Willey** managing director of Murex Welding Processes.

New appointments are announced within the Delta Metal group. **Mr. A. F. Thomas,** an assistant managing director of the Delta Metal Company, is appointed to the board of Sperryn and Company, and **Mr. D. J. W. Dolton** has also been appointed to the boards of both companies.

News from Silvercrown Limited is that **Mr. Bert Oade** will be taking over as North-Western area sales representative for the company and will be located at the company's depot at Trafford Park. Prior to joining Silvercrown Limited, Mr. Oade was with J. P. Fielding and Company Limited and Metropolitan-Vickers Electrical Company Limited.

Council members of the British Compressed Air Society elected at the annual general meeting held last week are as follows: **Mr. P. C. Bevis, Mr. D. A. Hannay, Mr. E. A. Martin, Lt.-Col. K. Reavell, Mr. R. A. Rust, Col. R. W. W. Taylor, Mr. C. T. Wardman, Mr. J. M. Williams,** with **Mr. I. E. Graham** and **Mr. S. A. Gregory** as associate council members. At the first meeting of the Council, **Lt.-Col. K. Reavell** was elected President, and **Col. R. W. W. Taylor,** Vice-President of the Society. **Mr. T. C. Hore** was re-elected hon. technical director.

Trained under the Birfield Group Apprentice Training Scheme, six apprentices have gained Diplomas in Technology offered by the National Council for Technological Awards as follows: **Mr. A. J. Stapley** (Hardy Spicer Limited), metallurgy; **Mr. J. A. Allcott** (Hardy Spicer Limited), mechanical engineering; **Mr. V. S. Cornock** (Forgings and Presswork Ltd.), mechanical engineering; **Mr. T. F. Parr, Mr. R. Sale** and **Mr. R. E. Cope** (all of Hardy Spicer Limited), production engineering. It is understood that these apprentices formed the first group to enter for diplomas.

It has been announced by the Brightside Foundry and Engineering Company Limited that **Mr. Kenneth Arthur Oliver** has been appointed chief metallurgist to the company as from tomorrow (April 1).

Flying to America at the end of next week is **Mr. D. J. W. Boag,** managing director of Rockweld Limited. He will attend the 1961 annual assembly of the International Institute of Welding in New York.

Chairman of Tempered Group Limited, of Sheffield, **Mr. Gerard Young** has arrived in the United States for the purpose of visiting New York, Detroit, and other cities to appoint distributors for various group products.

News from the Institution of Works Managers is to the effect that three new Vice-Presidents have been elected as follows:—**Mr. E. J. Hunter** (chairman of Swan, Hunter and Wigham Richardson Ltd.), **Mr. J. R. Edwards** (managing director of Pressed Steel Company), and the **Hon. Geoffrey Rootes** (deputy chairman and managing director of Humber Ltd.).

Reviews of the Month

NEW BOOKS AND THEIR AUTHORS

METALLOGRAPHY

"A History of Metallography." *By Cyril Stanley Smith. Published by Chicago University Press and Cambridge University Press, Bentley House, Euston Road, London, N.W.1. Pp. xxi+291. Price 68s.*

THE dedication of this book reads—"To those craftsmen whose intuitive understanding of materials provided the seed from which metallurgical science grew". The author, Professor Cyril S. Smith, is such a craftsman and his book has been prepared with all the care and attention to detail that would be expected from one so talented. The title does not disclose that here is a "classic" of information on all those aspects of metallography little known to present day metallurgists. One volume, well illustrated, expertly presents the entire story of metal science up to the year 1890. This arbitrary date is chosen because "metallography had by then begun to crystallize into a definite discipline".

It is perhaps the inclusion of such fascinating evidence as the reports on Tibetan and Damascan sword blades in the opening chapters that enhance this book beyond the standard possible in purely historical narration. In scanning the book, one's attention is held by the photomicrographs of steel which was worked by the artisans of the early centuries A.D.

There is considerable speculation on the nature of the Indian steel known as "wootz" which made such fine weapons but which defied the attempts of many reputable European smiths to forge it in the 17th and 18th centuries. Wootz has the characteristic damask or water pattern structure which was developed to advantage in the ornamentation of armour.

Corrosion workers of the present day will be interested in the record made in 1409 of "a water which corrodes iron". Nitric acid in its early days, when prepared from dry ingredients, vitriol, saltpetre and alum excelled in the title of "eau de depart".

It is only in the latter half of the book that the reader is introduced to the early microscopists of metals, Sorby, Martens and Osmond. These men were not well served with prepared abstracts, the services of professional institutions and all the background guidance available today, but they applied themselves to their chosen vocation with rare enthusiasm. To Martens and Sorby, in particular, the life's work for which they are honoured was virtually a part-time occupation, and Professor Smith has presented a tremendous wealth of facts about their activities.

The book concludes with two important appendices—"Experiments of Etching on Iron and Steel" by Rinman, written in Stockholm in 1774, and "On the Microscopical Structure of Iron and Steel" by H. C. Sorby, written in Sheffield in 1885.

This review would not be complete without its recommendation to all those who value quality and originality in their scientific reading. This volume will not assist in breaking any modern production records, but it will be deeply satisfying to those metallurgists with the desire and capacity to enjoy reading an account of all that pioneered our skills in metallographic study.

P. E. W.

METAL FINISHING

"Jahrbuch der Oberflächentechnik 1961." *Published by Metall-Verlag G.m.b.H., Berlin-Grunwald Hubertusaller 18. Pp. 1072. DM.22.50.*

AS USUAL, this year-book is an excellent guide to the metal finishing industry in Germany.

The first chapters deal with mechanical surface treatment methods, such as barrel polishing, abrasive belt linishing and abrasive blasting, diamond tipped tools, and the polishing of plastics. New methods like spark machining, ultrasonics, as well as descaling and etching are described, together with chromating and phosphating of aluminium.

Interesting topics mentioned in the electroplating section are the pre-treatment of copper alloys, gold plating solutions, duplex and sandwich coatings, as well as impurities in electrolytes.

The relative merits of hot dipping and electro-galvanizing are discussed, as well as the arc welding of hot-dipped galvanized steel. Vitreous enamel, ceramic and metal sprayed coatings and, finally, organic coatings are reviewed.

The book should be of use to anyone who wishes to acquaint himself with the present position of the metal finishing trade in Germany. **G. S.**

STAMPING

"Practical Design of Sheet Metal Stampings." *By F. Strasser. Published by Chapman and Hall Ltd., 37 Essex Street, London, W.C.2. Pp. viii+175. Price 50s.*

WRITTEN for those directly concerned with cold and hot metal stampings, pressings and deep drawing techniques, this book has been divided into three principal parts: (a) basic concepts; (b) details of design; and (c) special problems.

There are 549 drawings and illustrations and some formulae to help the reader to appreciate the script. The problems of burrs, which cannot altogether be avoided, may, by correct design and die materials, be kept within reasonable limits, and a few illustrations are shown of typical unfavourable stamping designs which tend to promote burr formation.

The book contains some valuable hints for those engaged in deep drawing operations: how to produce sharp corners on flanges and shell bottoms; embossing and threading of brass and aluminium pressings. Sizing, coining, cold heading and ironing the walls of deep drawn shells are referred to very briefly. Economical layout of strip to obtain minimum scrap with a minimum of rejects is discussed, giving comparisons between steel, hard brass and bronze with the softer metals, copper and aluminium. Evidently, shape of the stampings plays an important part in the amount of metal that must be allowed in the strip and that rejected as scrap. The writer rightly claims that close collaboration between the designer and shop operators is important for economical productivity.

Important functions and operations are given bold paragraph headings, and the author has to be commended for his logical arrangement of the subject matter, his coherence of expression without vagueness or exuberance, and the ample supply of illustrations.

D. Ll.

CERMETS

"Cermets." *Edited by J. R. Tinklepaugh and W. B. Crandall. Published by Reinhold Publishing Corporation, New York, and Chapman and Hall Ltd., 37 Essex Street, London, W.C.2. Pp. vi+239. Price 70s.*

THE complete information on properties, forming, testing and uses . . . claimed on the dust jacket, is modified by the statement in the preface that there has been no previous effort to present a representative cross-section of this information in one volume. By implication, therefore, that is what this book sets out to do, with the further qualification that the scope has been limited to the United States, with no attempt made to describe the extensive and important work of European research workers: That the result is disappointing is due in probably equal measure to the nature of the work and to the manner in which it is presented.

The work—at least up to the point to which the present cross-section of it extends—appears to have been based essentially on the principle of trying everything once. The presentation includes everything that has been done, written up in a rather disparate manner by the people who have done it or who have been associated with the work. Their contributions range from a long chapter on the physico-chemical aspects

of cermets, through lengthy chapters on slip casting, alumina-metal cermets, chromium-alumina base cermets, and titanium carbide-metal infiltrated cermets, to a contribution on cermets in friction materials. From this last, one can gather that they contain ceramic constituents and are either bronze-base or iron-base. Three-quarters of a page is devoted to the preparation of carbides and a half-page contribution deals with explosive isostatic pressing (of cemented titanium carbide compositions in a surplus 14-in. gun from World War II). Miscellaneous topics discussed in in-between contributions include metal-modified oxides (zirconia with a small addition of titanium), electronic refractory cermets (thoria-tungsten cermets used in magnetrons and other short-wave generating devices), metal-fibre reinforcement and metal-cladding of cermets and ceramics, the impact testing of cermets and the applications of cermets to nuclear devices and aircraft power plants. Fortunately, there is a good subject index. In addition to the literature references at the end of most of the chapters, there is also a bibliography on cermets (1950-1956) comprising 544 references.

A monograph on cermets—after the term has been defined to exclude, for example, heat-treatable and machinable 33 per cent by weight titanium-carbide-67 per cent chromium - molybdenum alloy steel—still remains to be written.

A. B.

ARC WELDING

"Theory and Practice of Arc Welding." *By R. J. Sacks. Published by D. van Nostrand Company Inc., 358 Kensington High Street, London, W.14, and Princeton, New Jersey. Pp. xii + 478. Price 45s.*

EXCELLENT for students and lecturers taking courses in welding, this book has some useful references to preparation for welding, welding electrodes and their coverings. The book contains many good illustrations which will be of great help to students and to welding engineers.

Testing of welds, safety precautions, and lessons in cutting and arc welding, inert gas shielded, tungsten arc welding, advanced welding and blueprint reading are dealt with. The chapters on welding definitions, although American, are very useful indeed. This is the second edition of this handbook.

WELDING PRACTICE

"Welding Handbook." *Section 3. By A. Phillips. Published by American Welding Society and Cleaver-Hume Press Ltd., 31 Wrights Lane, Kensington, London, W.8. Pp. vi + 503. Price 72s.*

THIS Section 3 of the fourth edition of this book deals with special welding processes and cutting techniques. These not only tax the mind of the engineer, but they become a vital part of metallurgical science, too, for by using a certain technique in welding it is now possible to produce relatively pure metals, though it may be said that this process, known as the electro-slag process, is not mentioned in this volume.

The hard surfacing of metals by various ferrous and non-ferrous alloys, such as cobalt-chromium base alloys, tungsten carbide base alloys and copper base alloys is worthy of attention. The design of joints for brazing is well covered and illustrated.

Ultrasonic, induction and stud welding processes are included in the manual.

There are some useful chapters on cutting, which include some notes on the chemistry of oxygen cutting, diffusion factors related to carbon migration and alloy precipitation; underwater cutting for salvage work and repairs; cutting stainless steel using the powder technique, etc. Arc cutting includes the use of carbon, covered metallic arc electrodes, oxygen-arc cutting and gas-tungsten-arc cutting. References are made to cutting of aluminium, stainless steel and copper materials.

This is a good reference book on welding processes but, unfortunately, it may soon be outdated by the progressive researches that are being made throughout the industry all over the world.

I. W.

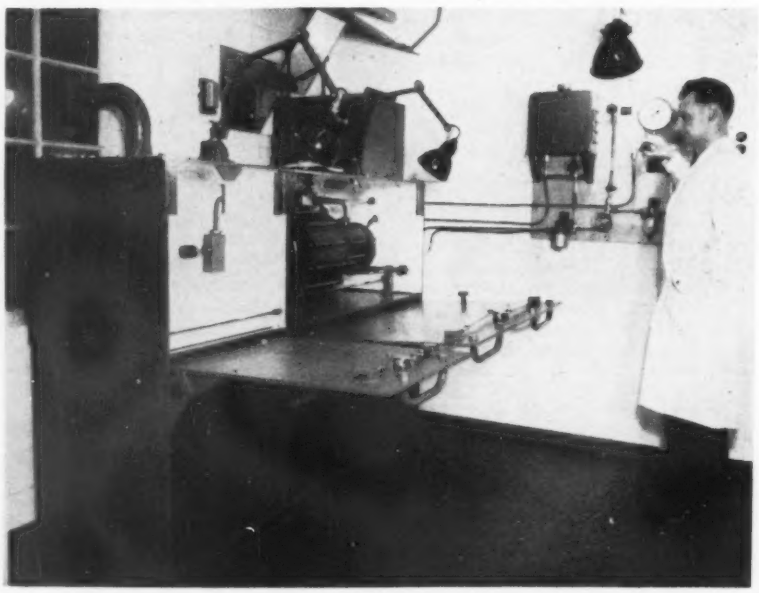
High Pressure Testing

TO meet the increased demand for higher hydraulic pressures, Charles S. Madan and Co. Ltd., of Altrincham, have added a new model to their range of "Airhydro-pumps". This produces pressures up to 100,000 lb/in^2 from compressed air at 80-100 lb/in^2.

This is a reciprocating pump with an output of just over 6 in^3/min. at 10,000 lb/in^2, falling to just under 2 in^3/min. at 90,000 lb/in^2. The pressure is fully controllable from 10,000 lb/in^2 to 100,000 lb/in^2 by means of the air control valve. The pressure may be raised gradually by hand, or alternatively, the air control valve may be set to produce the required pressure. When the air is switched on, the pump will reciprocate until the preset pressure is reached, when it will come to rest in a state of balance, and the pressure will be maintained indefinitely without consuming any air. If there is a leak in the article under test the pump will continue to reciprocate.

A complete range of control valves, pressure release valves, elbows, Tees and couplings have been designed for use with the pump and are made in a high quality steel heat-treated and normalized, and tested to 120,000 lb/in^2. The Madan High Pressure Pipe Connection is claimed to be satisfactory at pressures up to 132,000 lb/in^2. The connection can be made and broken repeatedly.

The V.H.P. Airhydropump and associated equipment. The pump is mounted in a steel safety cabinet with a separate compartment for the article under test and with all controls outside. The pressure gauge is also protected and is viewed through mirrors. The doors of the safety cabinet are electrically controlled to prevent their being operated while the system is under pressure



Industrial News *Home and Overseas*

World Tin Position

World mine production of tin-in-concentrates showed almost no change in November at 13,600 tons, but rose in December to 14,400 tons, according to the February statistical bulletin of the International Tin Council. World production during 1960 was approximately 159,000 tons, compared with 141,000 tons in 1959 and 135,000 tons in 1958. In 1957, the most recent year in which production was almost wholly unaffected by export controls under the International Tin Agreement, world production was about 180,000 tons.

World smelter production of tin metal rose from 13,600 tons in October to 14,000 tons in November. World production during 1960 as a whole is provisionally estimated at approximately 171,000 tons, compared with 136,000 tons in 1959 and 140,000 tons in 1958.

Exports of tin metal from the United Kingdom in 1960 amounted to 7,771 tons, compared with 29,370 tons in 1959. The exceptionally high 1959 figure resulted from heavy sales of metals from the I.T.C. buffer stock. Exports of metal from Belgium in 1960, at about 7,800 tons, were higher than in 1959 (6,212 tons) but exports from The Netherlands declined further to 12,234 tons (19,721 tons in 1959).

Imports of tin metal into the United States declined from 43,494 tons in 1959 to 39,489 tons in 1960. Imports of metal into Federal Germany rose very sharply in 1960; in the first 11 months of the year they amounted to 25,429 tons, compared with 17,300 tons in the whole of 1959 and 10,231 tons in 1958. Imports into France, Japan, Italy and the United Kingdom were also higher in 1960, but imports into The Netherlands and Denmark fell sharply.

Specialized Tools

A complete range of specialized tools which enjoy a wide acceptance in American industry are now to be manufactured and distributed by the **Birmingham Tool and Gauge Co. Ltd.**, who have signed an exclusive agreement with Madison Industries Inc., of Providence 4, Rhode Island, U.S.A., for the manufacture and distribution of their complete range of special tooling, covering the machining of holes from drilling to superfinishing. The range includes trepanning, boring and reaming tools, as well as automatic recessing tools, gun drills, boring bars and Microller burnishing tools.

Laboratory Equipment

A new company with the title **Engineering Laboratory Equipment Ltd.** has been formed jointly by Soil Mechanics Ltd. and Griffin and George Ltd. to provide a comprehensive service at home and overseas in connection with engineering laboratories.

The wide knowledge and experience of both parent organizations will be combined to provide for the design, construction and furnishing of engineering laboratories, together with the manufacture and supply of all the necessary testing apparatus and equipment, backed by a comprehensive after-sales service. The equipment supplied will be of the most modern design available, it will meet the needs of both research and general commercial practice, and will normally be available from stock.

The sales manager of the new company is Mr. John Readman and the technical manager is Mr. T. G. Clark.

Contract for Furnaces

News from **The General Electric Company Ltd.** is that they have supplied to Richard Thomas and Baldwins Ltd. a number of electric furnaces. These furnaces are installed in the Cookley works of the company at Brierley Hill, and comprise a continuous strip decarburizing furnace, a continuous strip inter-annealing furnace, and a number of bell-type furnaces for high-temperature annealing.

Showing at Moscow

Nineteen member firms of S.I.M.A., the **Scientific Instrument Manufacturers' Association of Great Britain,** will exhibit 500 instruments worth £220,000 and ranging from £1 4s. 1d. to £34,600 in individual value, on the joint S.I.M.A. stand at the British Trade Fair, Moscow, May 19 to June 4. The exhibits are appropriately situated in Hall C, adjacent to the British Government's display of British Scientific Achievements. The lowest priced article is an international standards mesh sieve and the costliest a transistorized, digital computer.

Electro-Heat Congress

Complete proceedings of the Fourth International Congress on Electro-Heat, held in Stresa, Italy, in May, 1959, have now been published in two volumes. Full details of these volumes may be obtained from the Secretary, the British National Committee on Electro-Heat, c/o The British Electrical Development Association, 2 Savoy Hill, London, W.C.2.

Site for New Works

It is understood that **Kestner Evaporator and Engineering Company Limited** are to transfer their London works from New Cross to Greenhithe. The new site covers 10 acres and is adjacent to the new Dartford Tunnel, so that direct access from and to the North can be made by by-passing London. The new works will be gradually brought into operation, commencing in June next and being completed towards the end of the year. Among other items there will be an extensive new laboratory embodying facilities for pilot plant and experimental testing.

Flexibox in Holland

A new company—Flexibox N.V.—will be added to the Flexibox organization next month to handle sales of the company's mechanical seals in the Benelux countries. This new firm has been formed jointly by **Flexibox Limited** and their present Dutch agents—Technisch Bureau Vaillant and Sluyterman.

Instruments and Controls

Commencing on Tuesday, April 25 next, the fifth annual Midlands exhibition of instruments and controls for industry, education and research will be held at the Central Y.M.C.A., Snow Hill, Birmingham. It will remain open until Friday, April 28. Some 500 devices from over 20 leading manufacturers will be on show, and technical details on a number of new instruments being exhibited for the first time will be released during this exhibition.

Admission tickets for this event may be obtained from **A. M. Lock and Company Ltd.,** Newborough Road, Shirley, Solihull, Warwickshire.

Lead and Zinc Production

Total refined pig lead production in the O.E.E.C. producer countries amounted provisionally to 61,804 metric tons in February compared with 58,959 metric tons in the previous month, the Organization for European Economic Co-operation announced in Paris last week. Total stocks of refined pig lead by the end of February in member nations, representing 99 per cent of European production, totalled provisionally 49,383 metric tons, against 54,212 recorded for January.

Final production figures by country of refined lead in January were (in metric tons): Austria 754, Belgium 6,939, Denmark 790, France 9,359, Germany 16,085, Greece 300, Italy 3,941, Holland 800, Spain 5,764, Sweden 3,409, and the U.K. 6,408.

Total production of lead ores and concentrates amounted to 29,876 metric tons of metal content (provisional) in February compared with January's 31,980 metric tons. The Organization said this level of production was about 11 per cent lower than in February last year. Final production figures of lead ores and concentrates in January (in metric tons of metal content) were as follows, reports the O.E.E.C.: Austria 500, French Commonwealth 2,705, Germany 4,584, Italy 3,947, Norway 235, Spain 5,518, Sweden 4,736, the U.K. 114, Morocco 7,990, and Tunisia 1,651.

Provisional figures for refined zinc show that O.E.E.C. producer nations put out 73,006 metric tons in February compared with 72,218 metric tons in the previous month. Some 27,800 metric tons were of high grade and special high grade zinc (at least 99.95 per cent zinc content) and 45,206 were of other grades. Stocks of refined zinc at end-February totalled provisionally 45,875 metric tons, against January's 48,856 metric tons.

Advance Tin Statistics

Mine production of tin-in-concentrates in the Federation of Malaya declined slightly in January to 4,565 tons, against 4,646 tons in December, the International Tin Council states. Output was also slightly lower in January in Indonesia (1,349 tons, compared with 2,044 tons in December) and Nigeria (640 tons, compared with 684 tons in December).

Smelter production of tin metal in Malaya and Singapore declined further in December to 6,391 tons, but recovered to 7,227 tons in January. Production in the United Kingdom fell from 2,292 tons in January to 1,977 tons in February. Output of tin metal in Belgium declined from 853 tons in December to 736 tons

in January; in February there was a further fall to 414 tons.

Provisional figures of exports of tin metal from Malaya and Singapore in February showed a decline to 5,204 tons compared with 6,295 tons in January. Exports of metal from The Netherlands fell from 499 tons in December to 370 tons in January. Exports from Belgium in January and February are provisionally given as 750 tons and 588 tons, respectively.

Imports of tin metal into the United States rose from 2,523 tons in November to 3,108 tons in December. Imports into Federal Germany fell to 2,617 tons in December, compared with 3,397 tons in November.

Stocks of tin-in-concentrates at mines, in transit and at smelters in Malaya and Singapore rose to 7,576 tons at the end of December, compared with 6,981 tons a month earlier.

Stocks at smelters in Belgium rose to 1,187 tons at the end of January and 1,219 tons at the end of February. Stocks at smelters in the United Kingdom were again lower at the end of February (1,254 tons as against 1,580 tons at the end of January).

Stocks of tin metal with consumers in the United States were slightly higher at the end of December at 21,200 tons (end-November 21,095 tons).

Swedish Aluminium Foil

A new aluminium foil plant has been opened at Skultuna by AB Svenska Metallverken. It will have a total capacity of 1,500 tons a year. The old plant was at Finspang; it started working in 1936 with an annual capacity of about 100 tons and at the present time this had risen to 1,100 tons a year. The new plant's manager expects the Skultuna facility to produce about 1,200 tons this year.

Bauxite Discovery

According to news from Sierra Leone, mining of bauxite is likely to begin in the Mokanji hills in Sierra Leone's South-Western Province early next year. The Government's geological department has carried out extensive prospecting in that area on behalf of the Swiss Aluminium Company, of Zurich. During the course of the prospecting, 250 drill holes were sunk, and the mineral occurs in a narrow band over a length of about 18 miles, and the thickness of the deposit varies up to a maximum of about 70 ft. and averages about 30 ft.

Annual Conference

Blackpool is to be venue for the 1961 Annual Conference of the **Institution of Plant Engineers,** which will be held from April 19 to 21. The programme includes a number of authoritative Papers of wide scope and interest, and generous provision has been made for discussion and the exchange of ideas and experience. The Presidential address will be delivered by Mr. G. D. Jordan, M.Eng., A.M.I.Mech.E., and the principal speaker at the conference dinner will be Mr. T. S. Kilpatrick, director and general manager of Steel, Peech and Tozer, branch of the United Steel Companies Ltd.

Canadian Copper for Japan

It is reported from New York that the Mitsubishi International Corporation has made arrangements to take the entire output, mainly copper, from the Consolidated Mining and Smelting Company of Canada's Wedge property, near Bathhurst, N.B. The entire output of about 750 tons daily will go to Japan, according to Mr. E. Yokoyama, vice-president of Mitsubishi. The first shipment is expected to be made during the first half of 1962. The Wedge mine is expected to be in production by the end of 1961.

Chilean Copper Prices

Chile is to seek a more stable price for copper at an international conference on copper to be held in Helsinki shortly, according to a reliable source close to the Copper Department — the official body which controls all copper sales in New York. The source said that under the Chilean proposal, the price would have a maximum level of 33 cents per lb. and a minimum level of 28 cents.

The Chilean proposition would be put forward unofficially as a matter not included in the conference agenda. In view of the anti-monopolistic legislation in the United States which forbids any move to fix a maximum on copper prices, the source added that Chile would propose a formula which tended to avoid putting the American copper companies in Chile in a position which violated such legislation.

Copper in United States

Domestic consumption of copper by brass and wire mills and foundries based on their shipments of fabricated products in February totalled 96,386 short tons compared with 100,836 in the previous month, says the U S. Copper Association. New business booked by fabricators in terms of refined copper to be used amounted to 102,905 short tons (97,592). Unfilled orders on fabricators' books at end-January totalled 129,535 (123,016).

Fabricators' stocks of refined copper at end-December were 451,695 (455,052) and orders on hand with producers amounted to 85,036 (73,328). Fabricators' receipts from producers were 93,029 (99,794), their gross reserves 536,731 (528,380) and their working stocks 368,828 (370,616).

Compressed Air

At the annual luncheon of the **British Compressed Air Society,** held in London last week, Mr. E. C. Beck, managing director of John Mowlem and Company Ltd., spoke on the subject of the constructional engineering industry overseas. He mentioned that, in spite of financial, and in some cases political, risks, work abroad by U.K. constructional engineering firms amounted to £130,000,000 per annum; and referred to the great amount of plant, including compressed air equipment, required for any large contract.

The luncheon was followed by the annual general meeting of the society, and in the early evening Mr. G. H. Hardy, of the War Office, gave a technical address on the testing of air compressors required for arduous conditions.

The Thompson Project

On Saturday last, March 25, the **Hon. Duff Roblin,** Premier of Manitoba; **Henry S. Wingate,** chairman of the Board of International Nickel, and **J. Roy Gordon,** President of the company, officially signalled the start of operations at the new Thompson Development of **International Nickel Company of Canada Limited,** in Northern Manitoba, Canada. This was done by the symbolic cutting of a ribbon—appropriately made of nickel—at the shears in the refinery building. Then, shearing operations were started to prepare for shipment to world markets the first refined nickel produced at Thompson in the world's first fully integrated nickel mining and processing plant.

The $185,000,000 Thompson project, of which the cost to International Nickel is approximately $130,000,000, is exceeded in size only by the company's operations in Ontario. It will increase Inco's annual nickel-producing capacity by more than 75,000,000 lb., bringing it to more than 385,000,000 lb. The plant, highly mechanized to effect economical production, consists of mine, headframe and concentrator, smelter, refinery and service buildings. The refinery employs a new process which was developed by company research scientists and engineers. Power for the operations, and for the adjacent new town of Thompson, is furnished by the Kelsey Generating Station of the Manitoba Hydro-Electric Board, on the Nelson River, 53 miles to the north-east.

There are, at present, 1,800 employees in the plant. This figure will increase soon to 2,300. The town of Thompson has been planned to accommodate a population of 8,000 with provision for expansion.

Premier Roblin said that "the establishment of this new, major industry is another step in the developing economic might of the nation. Indeed, through its products it will contribute to the advancement of the free world. With the need to create new international markets to sustain our economic growth, the export of a finished product—electrolytic nickel—has important ramifications".

Mr. Wingate stressed that the project permitted the continuation of the development and growth of the nickel industry and, at the same time, strengthened Canada's position as the most dependable source of nickel. Inco's operations in Ontario, and now in Manitoba, were ideally situated, he said, to serve nickel consumers the world over.

Others who spoke during the ceremonies included the Hon. Paul Comtois, Canadian Minister of Mines and Technical Surveys, the Hon. Charles H Witney, Manitoba Minister of Mines and Natural Resources, and Robert Simpson, Member of the Canadian House of Commons for Churchill. Leaders of business and industry from the United States, the United Kingdom and Europe as well as from Canada, were also among the guests. Congratulatory messages from Government officials in Canada, the United States and the United Kingdom were read.

The town of Thompson is located on the Burntwood River, on a picturesque 3,000 acre site provided by International Nickel, which also defrayed the cost of town planning, utilities engineering and installation of such basic facilities as underground storm drainage and sanitary sewer systems, a domestic water supply system, roads and sidewalks, a sewage disposal plant, a municipal administration building and fire station, and the four completely furnished schools—including a high school —to accommodate the requirements of the growing population. International Nickel has also built and operates a modern, fully-equipped hospital and a water treatment plant. Inco's contribution to the development of the town is estimated at approximately $8,500,000.

Houses are being built by private contractors for sale or rent to employees of the company and other residents of the town. Every street and public facility

has been laid out in accordance with a master plan which Inco arranged to have developed by the Metropolitan Planning Commission of Winnipeg. The serviced land and certain facilities become the property of the local government district of Mystery Lake and the District School Board when completed. By the re-sale of the fully serviced land for business or residential purposes, it should be possible for the town to expand without resort to borrowing, and thus keep municipal taxes at a minimum.

Morgan Products

As from tomorrow (April 1), the activities of the crucible and furnace departments of the Morgan Crucible Company Ltd. will be carried on by **Morganite Crucible Limited,** Norton Works, Woodbury Lane, Norton, Worcester, but their furnace demonstration and test foundry will remain at Battersea.

Not Practicable

The Councils of The Iron and Steel Institute, The Institute of Metals and The Institution of Metallurgists have recently examined the problems of closer co-operation between these three societies. After careful consideration they have concluded that amalgamation of the three societies would not be practicable within the foreseeable future. The three Councils, therefore, decided to set up a permanent Joint Consultative Committee of the three societies, which will meet regularly and advise their Councils on all activities and questions of common interest.

The three Councils are convinced that every qualified metallurgist should be a member both of the professional institution and of his appropriate scientific and technical institute, and should contribute to and influence the work of both. With this in view, the Council of The Institution of Metallurgists has altered the standard subscriptions payable by members, enrolled graduates and enrolled students of the Institution resident in the United Kingdom; by agreement of the three Councils, all those in The Institution of Metallurgists who pay these revised standard subscriptions will automatically have the right to apply for membership of one of the two Institutes without liability for the payment of a further membership subscription to that Institute.

U.K. Metal Stocks

Stocks of refined tin in London Metal Exchange official warehouses at the end of last week rose 273 tons to 10,263 tons comprising London 4,291, Liverpool 3,914 and Hull 2,058 tons.

Copper stocks fell 415 tons to 14,850 tons, distributed as follows: London 625, Liverpool 12,250, Birmingham 100, Manchester 1,825, and Hull 50 tons.

Lead duty-free stocks fell 25 tons to 7,014 tons comprising London 6,989 and Avonmouth 25 tons. Lead in-bond stocks were unchanged at 3,867 tons, all supplies being in London.

Zinc duty-free stocks rose 282 tons to 3,540 tons, while in-bond stocks fell 50 tons to 250 tons, comprising London duty-free 1,716 and in-bond 250 tons, Liverpool duty-free 1,794 tons and in-bond nil, and Glasgow duty-free 30 tons and in-bond nil tons.

Stainless Aluminium

News from U.S.A. is that Fairmont Aluminum Company, a subsidiary of Cerro Corporation has announced that it has successfully joined, by molecular bonding, aluminium sheet to stainless steel. Having completed extensive field testing on hundreds of samples of the dual metal, the company is now ready to offer to the metalworking industry its stainless clad aluminium.

In making the announcement, Fairmont Aluminium President, Robert T. Farrell, said, "the process by which we developed our stainless clad and our entry into this new field can be expected to have significant effect on the company's future". He added, "we believe stainless clad's influence will also be reflected throughout the metalworking industry.

Showing at Moscow

An exhibit likely to arouse keen interest at the forthcoming British Trade Fair in Moscow is that of **Rockweld Limited,** who will show a variety of welding equipment. This will include welding transformers, special electrodes—including the Meteor iron powder electrode—and the EB weld insert. The Comet semi-automatic visible arc welding process will also be shown.

Rockweld's energetic interest in export markets was further evidenced with the visit of Mr. D. J. W. Boag, managing director, to Russia last year, when he led the British delegation to the all-Union Welding Exhibition in Moscow. It will also be recalled that the company made a previous showing behind the Iron Curtain at the 1960 Poznan Fair.

Change of Name

It is reported that the Ayrshire Dockyard Company, of Irvine, is to change its name to **Ayrshire Metal Products.** In view of the fact that ship repairing has been abandoned, the company feels that its new title is more appropriate. It is proposed now to concentrate on light engineering activities, including cold formed sections, metal partitioning and other metal products.

Diffusion Furnaces

New high temperature diffusion furnaces, designed to meet exacting temperature requirements, have been installed in the Transistor Division of Standard Telephones and Cables Ltd. The furnaces were supplied by **Royce Electric Furnaces Ltd.** and are used in the production of high frequency, double diffused silicon transistors.

The furnaces are self-contained units incorporating a floor standing cabinet which houses all the electrical gear, including control instruments, switchgear and transformers. They are suitable for use with nitrogen, oxygen and hydrogen atmospheres and are designed to take work tubes of either impervious fused alumina or transparent silica having an inner diameter of 2 in.

Each furnace has both a preheat and a high temperature section, the preheat section being mounted on wheels so that it can be moved to and from the main chamber and locked in the required position. The furnaces are rated at 7½ kW.

Forthcoming Meetings

April 4—Institute of Metals. — Oxford Local Section. Cadena Café, Cornmarket Street, Oxford. Annual General Meeting, followed by "Ductile Fracture". Prof. R. W. K. Honeycombe. 7.15 p.m.

April 5—Institution of Plant Engineers. Southern Branch. Grand Hotel, Bournemouth. "Radioactive Isotopes in Industry." 7.30 p.m.

April 6—Institute of Metals Birmingham Local Section. College of Technology, Gosta Green, Birmingham. Annual General Meeting. 6.30 p.m.

April 6—Institute of Metal Finishing. North-West Branch. Engineers' Club, Albert Square, Manchester. Film show —"Growth of an Electrodeposit". S. C. Barnes. 7.30 p.m.

April 6—Institute of Metals. London Local Section. 17 Belgrave Square, London, S.W.1. Annual General Meeting, followed by "Physical Methods of Analysis for Major Alloying Constituents". K. M. Bills. 6 p.m.

Birmingham Metallurgical Society

NOW in its 58th year, the Birmingham Metallurgical Society (Inc.) held its annual dinner and dance at the Pavilion Suite, Edgbaston, Birmingham, on Wednesday of last week under the chairmanship of the President of the Society, **Mr. L. G. Beresford,** B.Sc., F.I.M. Some 135 members and guests attended the function, at which the principal guests were **Mr. Evan A. G. Norton,** C.B.E., M.A. (chairman of British Rollmakers Corporation) and **Sir Geoffrey Bourne,** G.C.B., K.B.E., C.M.G. (director-general of the Aluminium Development Association).

Proposing the toast of "The Society", Mr. Evan A. G. Norton jocularly referred to metallurgists as "crystal gazers", but went on to say that with the changing status of those countries which had remained until now under-developed, a corresponding change occurred in the types of goods and services those countries would need. They were rapidly learning manufacturing techniques, but this need give the metals industry no serious concern. In spite of curbs on import quotas they would continue to need all that advanced techniques and equipment could offer.

The President of the Society briefly thanked Mr. Norton for his good wishes.

Calling on members to drink the health of "The Guests", **Mr. S. G. Temple,** M.Sc., F.I.M. (Imperial Chemical Industries Limited, Metals Division), after referring to the ladies present, mentioned that among those representing other societies were **Mr. F. V. Wright** (President of the Staffordshire Iron and Steel Institute), **Mr. C. Wharrad** (national chairman of the Metal Finishing Association), and **Mr. R. C. Woodward** (chairman of the Birmingham branch of the Purchasing Officers' Association). He also welcomed **Mr. D. A. Bostock-Smith** (director of Iliffe Production Publications Limited).

Replying to this toast, Sir Geoffrey Bourne drew some comparisons between army and industrial life, and urged industrialists to ensure that real progress was made at the many committees on which they sat. He went on to speak of his service contact with Russians, and urged metallurgists to appreciate Russian humour, Russian attention to the letter of agreements, and their recognition of superior force.

Metal Market News

PRICES on the Metal Exchange last week were fully steady and on balance there was not much change in values. Market operations in lead and zinc were somewhat overshadowed by the fact that an international meeting was in progress in Mexico which, it was hoped, would produce results calculated to improve the statistical situation of one, if not both of these metals. In fact, there did not seem to be much idea that anything would be done for zinc, but hopes have been running high that an agreement would be reached to benefit lead by means of a decision to curtail production. Alternatively, there was an idea that the American Government might barter surplus farm produce against lead, which would then be stockpiled. As we write, the final outcome of the talks in Mexico is unknown, but since Australia announced some weeks ago that she had no intention of reducing her output of lead it is obviously going to be pretty difficult to persuade other countries, particularly, perhaps, Spain, that a policy of curtailment should be adopted.

Dealing in the standard copper market was rather patchy, but there were a few days when the turnover was up to average which this year so far, including Kerb business, has been running at about 3,000 tons daily. During the week, the contango varied from 20s. to 30s. and, judging by the proportion of deals put through for the three months position, it looks very much as though there was a good deal of hedging business on the market. Tin was firm throughout the period on the statistical outlook, which, later on, could well become quite difficult. With a premium for the forward quotation of about £2, the tin market offers a good opportunity for hedging operations but it may well be doubted whether much advantage will be taken of this, inasmuch as people with a long position in the metal are probably not averse from waiting for a profit on their unsold tonnage.

In the United States, the situation seems slowly but, it must be hoped, surely, to improve, but in spite of optimism on Wall Street it is likely to be several months yet before the economy is back to something approaching normal. In copper, the price remains rock steady at 29 cents, but last week scrap moved up by 25 points. On the London market the quotation closed unchanged for cash at £226 10s. 0d., and 5s. up three months at £228. The turnover was 11,200 tons. Stocks fell by 250 tons to 15,265 tons. Tin was very firm and on a turnover of 1,120 tons both positions gained £8, at £825 10s. 0d. for cash, and £827 three months. Warehouse stocks were unchanged at 9,990 tons. Some 6,350 tons of lead changed hands, cash losing 2s. 6d. at £67, and three months 12s. 6d. at £68 7s. 6d. Zinc lost 30s. for cash at £84 5s. 0d., and 17s. 6d. three months at £83 12s. 6d. Some 7,450 tons changed hands.

Birmingham

Reduction of short time operation in the motor trade has brought a big decline in the number of unemployed in the Midlands. Figures published by the Ministry of Labour show that the total without work or working less than a full week is 31,848, compared with 40,178 a month ago. The main reduction was in the number of men over 18 who were temporarily stopped, which dropped from 17,820 to 11,318. These new figures bring the percentage rate of unemployment to 1·5 per cent, compared with 1·6 per cent for the country as a whole. Most of the big car firms are back on the five day week, and the trade's output is believed to have recovered from less than half its full capacity to about three-quarters.

Output in the iron foundries has risen following an all round expansion in demand from the engineering industries and gradual improvement in the motor trade. Electrical contractors engaged on power plant are particularly busy. The re-rolling mills are active on reinforcing rods and bars. Supplies of semi-finished steel are ample to cover current needs, and stocks are available at most works. The time required for delivery of constructional steel is lessening slightly, because although the heavy rolling mills are well booked, new business is coming in on a rather slower basis.

New York

Copper futures were steady at the week-end in fair dealings. Traders said there was little change to the physical copper market. Producers and custom smelters indicated satisfactory sales. The dealer market continued quiet. Tin was firm. Lead and zinc were reported in fair activity. Some sales of lead were transacted at the fixed price of 11 cents. In late trading, tin was quiet and steady. Scrap copper was unchanged.

It was reported from Washington that the United States has made a special assistance loan of $3,500,000 to Bolivia. The loan represents part of a $10,000,000 credit to Bolivia which was announced in La Paz in November last year. The loan is to help in rehabilitating the Bolivian Mining Corporation mines and concentration plants. The State Department said the loan represented the United States' contribution to the first phase of a triangular arrangement whereby the Federal Republic of Germany and the Inter-American Development Bank expected to make similar amounts available to Bolivia.

The platinum market was reported to be slightly easier in the week ended March 22. Leading refiners adhered to their officially advertized asking rates of $82 in bulk and $85 in smaller quantities. Dealers on the outside market, however, were able to make offerings at $80 and, in some instances, even a half dollar or a dollar cheaper. Consumption and demand showed no tendency to expand.

Canada

Record levels of aluminium consumption under conditions of "intense competition", excess production capacity and constant pressure on primary metal prices featured the aluminium industry last year in the non-Communist world, according to the annual report of Aluminium Limited. Mr. N. V. Davies said that while the industry continued to have over-capacity and idle facilities, and while it was estimated that primary aluminium consumption in the "free" world had increased by about 2 per cent last year, productive capacity had increased by an equal or greater tonnage. "Conditions are not likely to change in the near future", he added.

The company's consolidated sales at 705,100 tons were equal to those in 1956, the company's previous best year, he added. Mr. Davies said that net income at $39,100,000 compared favourably with the $24,000,000 net profit in 1959, but was still below the level of $55,600,000 recorded in 1958. Earnings per common share amounted to $1·28 last year, compared with $0·79 in 1959, he added.

Zurich

Lack of uniformity was one of the main features on the Swiss non-ferrous metals market during March. A number of long-term delivery contracts were concluded, but ordinary business tended to be dull. Trade quarters reported a slight rise in the demand for lead and zinc during the month under review, largely due to stock purchases by users induced by rumours of possible limitation of lead and zinc production. Buying interest in copper, on the other hand, abated somewhat since users expect prices to drop. While, at present, purchases on the Swiss non-ferrous metals market are limited to current needs, trade quarters take a favourable view of future prospects. Swiss metal prices followed the world market trend.

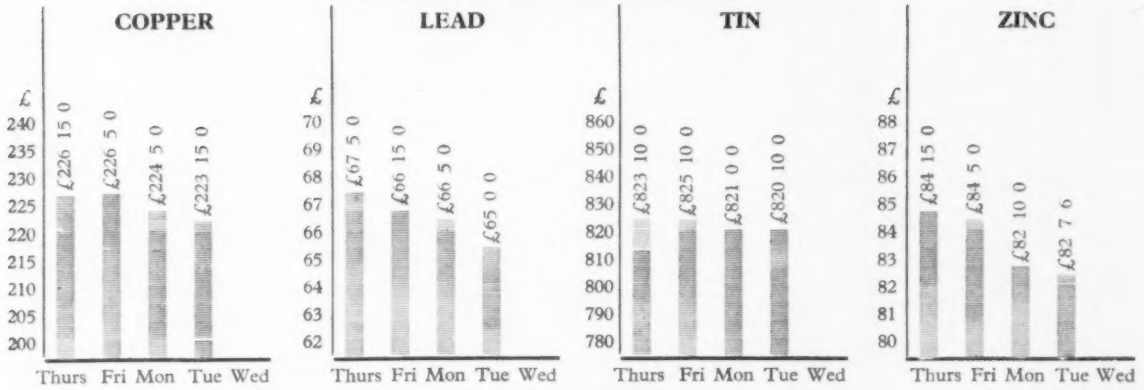
Spain

It was reported from Madrid at the week-end that licences to export some lead ingots and electrolytic zinc have been granted officially. Some 1,261 tons of lead ingots will go to Brazil (11), Denmark (500) and the United States (750). Espanola del Zinc SA has been granted a licence to export some 1,300 tons of electrolytic zinc to Brazil.

Non-Ferrous Metal Prices

London Metal Exchange

Thursday 23 March to Tuesday 28 March 1961



Primary Metals

All prices quoted are those available at 2 p.m. 28/3/61

		£	s.	d.
Aluminium Ingots	ton	186	0	0
Antimony 99·6%	,,	217	10	0
Antimony Metal 99%	,,	210	0	0
Antimony Oxide Commercial	,,	194	10	0
Antimony White Oxide	,,	196	0	0
Arsenic	,,	400	0	0
Bismuth 99·95%	lb.		16	0
Cadmium 99·9%	,,		11	0
Calcium	,,	2	0	0
Cerium 99%	,,	15	0	0
Chromium	,,		6	11
Cobalt	,,		12	0
Columbite	per unit		8	10
Copper H.C. Electro	ton	223	15	0
Fire Refined 99·70%	,,	222	0	0
Fire Refined 99·50%	,,	221	0	0

		£	s.	d.
Copper Sulphate	ton	77	0	0
Germanium	grm.		—	
Gold	oz.	12	10	9
Indium	,,		10	0
Iridium	,,	24	0	0
Lanthanum	grm.		15	0
Lead English	ton	65	0	0
Magnesium Ingots	lb.			
99·8%	,,		2	2½
99·9+%	,,		2	3
Notched Bar	,,		2	9½
Powder Grade 4	,,		5	6
Alloy Ingot, AZ91X		1	11¾-2	1¼
Manganese Metal	ton	280	0	0
Mercury	flask	69	0	0
Molybdenum	lb.	1	10	0
Nickel	ton	600	0	0
F. Shot	lb.		5	5
F. Ingot	,,		5	6
Osmium	oz.	20	0	0
Osmiridium	,,		—	

		£	s.	d.
Palladium	oz.	9	0	0
Platinum	,,	30	5	0
Rhodium	,,	46	0	0
Ruthenium	,,	16	0	0
Selenium	lb.	2	6	6
Silicon 98%	ton	122	0	0
Silver Spot Bars	oz.		6	7⅛
Tellurium Sticks	lb.	2	0	0
Tin	ton	820	10	0
***Zinc**				
Electrolytic	ton		—	
Min 99·99%	,,		—	
Virgin Min 98%	,,	82	5	0
Dust 95/97%	,,	125	0	0
Dust 98/99%	,,	131	0	0
Granulated 99+%	,,	107	5	0
Granulated 99·99+%	,,	122	6	3

**Duty and Carriage to customers' works for buyers' account.*

Foreign Quotations

Latest available quotations for non-ferrous metals with approximate sterling equivalents based on current exchange rates

	Belgium fr/kg≏£/ton	**Canada** c/lb≏£/ton	**France** fr/kg≏£/ton	**Italy** lire/kg≏£/ton	**Switzerland** fr/kg≏£/ton	**United States** c/lb≏£/ton
Aluminium		26.00 210 12	2.43 179 11	370 216 1	2.50 210 5	26.00 207 4
Antimony 99.0			2.30 170 0	500 292 0		29.00 231 2
Cadmium			15.75 1,069 0			150.00 1,195 10
Copper						
Crude				430 251 2		
Wire bars 99.9						
Electrolytic	31.00 226 11	27.50 222 15	3.15 232 15		2.75 231 5	29.00 231 6
Lead		10.00 81 0	.96 70 18	164 96 15	.78 65 11	11.00 87 13
Magnesium						
Nickel		70.00 567 0	9.00 665 2	1,180 689 2	7.50 630 15	74.00 589 15
Tin	113.75 831 7		11.61 843 3	1,530 893 10	9.65 811 11	103.87 827 16
Zinc						
Prime western		12.25 100 4 0				
High grade 99.95		12.85 104 17 0				
High grade 99.99		13.25 107 6 0			1.10 92 10	
Thermic			1.20 88 13			
Electrolytic			1.28 94 13	191 111 10		13.00 104 0

Non-Ferrous Metal Prices (continued)

Ingot Metals

All prices quoted are those available at 2 p.m. 28/3/61

	£	s.	d.
Aluminium Alloy (Virgin)			
B.S. 1490 L.M.5 .... ton	210	0	0
B.S. 1490 L.M.6 .... „	202	0	0
B.S. 1490 L.M.7 .... „	216	0	0
B.S. 1490 L.M.8 .... „	203	0	0
B.S. 1490 L.M.9 .... „	203	0	0
B.S. 1490 L.M.10.... „	221	0	0
B.S. 1490 L.M.11.... „	215	0	0
B.S. 1490 L.M.12.... „	223	0	0
B.S. 1490 L.M.13.... „	216	0	0
B.S. 1490 L.M.14.... „	224	0	0
B.S. 1490 L.M.15.... „	210	0	0
B.S. 1490 L.M.16.... „	206	0	0
B.S. 1490 L.M.18.... „	203	0	0
B.S. 1490 L.M.22.... „	210	0	0
Aluminium Alloys (Secondary)			
B.S. 1490 L.M.1 .... ton	171	0	0
B.S. 1490 L.M.2 .... „	174	0	0
B.S. 1490 L.M.4 .... „	180	0	0
B.S. 1490 L.M.6 .... „	181	0	0
***Aluminium Bronze**			
BSS 1400 AB.1..... ton			
BSS 1400 AB.2..... „			

	£	s.	d.
***Brass**			
BSS 1400-B3 65/35 .. ton			
BSS 249 ..... „		—	
BSS 1400-B6 85/15 .. „			
***Gunmetal**			
R.C.H. 3/4% ton .... „		—	
(85/5/5/5) LG2 ..... „			
(86/7/5/2) LG3 ..... „			
(88/10/2/1) ..... „			
(88/10/2/½) ..... „			
***Manganese Bronze**			
BSS 1400 HTB1..... „			
BSS 1400 HTB2..... „			
BSS 1400 HTB3..... „			
Nickel Silver			
Casting Quality 12% „	240	0	0
„ „ 16% „	255	0	0
„ „ 18% „	295	0	0
***Phosphor Bronze**			
B.S.1400P.B.1.(A.I.D. released) ..... „			
B.S. 1400 L.P.B.1 „			

**Average prices for the last week-end.*

	£	s.	d.
Phosphor Copper			
10% ..... ton	256	0	0
15% ..... „	260	0	0
Phosphor Tin			
5% ..... „	898	0	0
Silicon Bronze			
BSS 1400-SB1 ..... „	287	0	0
Solder, soft, BSS 219			
Grade C Tinmans ... „	377	0	0
Grade D Plumbers .. „	302	0	0
Grade M ..... „	415	0	0
Solder, Brazing, BSS 1845			
Type 8 (Granulated) lb.		—	
Type 9 „ „		—	
Zinc Alloys			
BSS 1004 Alloy A .. ton	115	16	3
BSS 1004 Alloy B.... „	119	16	3
Sodium-Zinc ..... lb.		2	7

Semi-Fabricated Products

Prices vary according to dimensions and quantities. The following are the basis prices for certain specific products.

Aluminium					
Sheet	10	S.W.G.	lb.	2	10½
Sheet	18	S.W.G.	„	3	0½
Sheet	24	S.W.G.	„	3	3½
Strip	10	S.W.G.	„	2	10½
Strip	18	S.W.G.	„	2	11½
Strip	24	S.W.G.	„	3	1
Circles	22	S.W.G.	„	3	4½
Circles	18	S.W.G.	„	3	3½
Circles	12	S.W.G.	„	3	2½
Plate as rolled			„	2	10
Sections			„	3	4
Wire 10 S.W.G.			„	3	1½
Tubes 1 in o.d. 16 S.W.G.			„	4	4
Aluminium Alloys					
BS1470. HS19W.					
Sheet	10	S.W.G.	„	3	3
Sheet	18	S.W.G.	„	3	5½
Sheet	24	S.W.G.	„	4	1
Strip	10	S.W.G.	„	3	3
Strip	18	S.W.G.	„	3	4½
Strip	24	S.W.G.	„	4	0½
BS1477. HP30M.					
Plate as rolled			„	3	1
BS1470. HC15WP.					
Sheet	10	S.W.G.	„	4	3
Sheet	18	S.W.G.	„	4	8½
Sheet	24	S.W.G.	„	5	8½
Strip	10	S.W.G.	„	4	4
Strip	18	S.W.G.	„	4	8½
Strip	24	S.W.G.	„	5	4½
BS1477. HPC15WP.					
Plate heat treated ...			„	3	10½
BS1475. HG19W.					
Wire	10	S.W.G.	„	4	2
BS1471. HT19WP.					
Tubes 1 in. o.d. 16 S.W.G.			„	5	5
BS1476. HE19WP.					
Sections			„	3	4
Split tube					
19 S.W.G. (⅛″)			„	4	2
20 S.W.G. (⅜″)			„	3	11
21 S.W.G. (¼″)			„	4	1
22 S.W.G. (¼″)			„	4	11
Welded tube 14 to 20 S.W.G. (sizes ½″ to 1½″)			„	3/10½ to 5/8½	

Brass					
Tubes			lb.	1	9½
Brazed Tubes			„	3	2½
Drawn Strip Sections			„	3	2½
Sheet			ton	200	5	0
Strip			„	200	5	0
Extruded Bar			lb.	2	0¼
Condenser Plate (Yellow Metal).....			ton	186	0	0
Condenser Plate (Naval Brass)			„	198	0	0
Wire			lb.	2	8¼
Beryllium Copper					
Strip			„	1	4	11
Rod			„	1	1	6
Wire			„	1	4	9
Copper					
Tubes			lb.	2	1½
Sheet			ton	259	5	0
Strip			„	259	5	0
H.C. Wire			„	278	15	0
Cupro Nickel					
Tubes 70/30			lb.	3	5½

Lead			
Pipes (London)	ton	107	0 0
Sheet (London)	„	104	15 0
Tellurium Lead	„	£6 extra	
Nickel Silver			
Sheet and Strip 10%..	lb.	3	10½
Wire 10%	„	4	3½
Phosphor Bronze			
Wire	„	4	1
Titanium (1,000 lb. lots)			
Billet 4½″ to 18″ dia....	lb.	47/-	48/-
Rod ¼″ to 4″ dia.....	„	85/-	53/-
Wire ·036″-232″ dia....	„	159/-	99/-
Strip ·001″ to ·048″....	„	350/-	68/-
Sheet 8′×2′. 20 gauge	„	73/-	
Tube, representative average gauge	„	198/-	
Extrusions	„	90/-	
Zinc			
Sheet	ton	120	15 0
Strip	„	nom.	

Domestic and Foreign

Merchants' average buying prices delivered, per ton, 27/3/61.

	£
Aluminium	
New Cuttings	141
Old Rolled	114
Segregated Turnings	79
Brass	
Cuttings	159
Rod Ends	143
Heavy Yellow	136
Light	130
Rolled	148
Collected Scrap	135
Turnings	136
Copper	
Wire	204
Firebox, cut up	201
Heavy	199
Light	196
Cuttings	206
Turnings	180
Braziery	176

	£
Gunmetal	
Gear Wheels	200
Admiralty.....	200
Commercial	184
Turnings	179
Lead	
Scrap	57
Nickel	
Cuttings	—
Anodes	550
Phosphor Bronze	
Scrap	184
Turnings	179
Zinc	
Remelted	79
Cuttings	66
Old Zinc	46

Financial News

Fescol

Trading profit, 1960, £99,635 (£84,659). Depreciation £24,493 (£23,521), tax £34,954 (£20,974), etc., leaving net profit £31,882 (£28,771). Preference dividend £2,358 (same), Ordinary dividend 15 per cent (same) and bonus 2½ per cent (nil), £10,710 (£9,180), to reserves £41,570 (£12,730), forward £15,055 (£37,811). Current assets £258,999 (£214,394), liabilities £82,160 (£70,515).

General Tin Investments

Group net revenue, 1960, £239,887 (£209,067) and dividend 14 per cent (12 per cent). Investments: of parent £3,117,038 (£2,930,881), valuation £5,793,278; of finance subsidiary £52,708 (£105,821), valuation £54,841.

Imperial Chemical Industries

Accounts for 1960 show gross profits at £88,000,000, before tax, and net profit at £47,572,000. The recommended dividend is at 13¾ per cent.

Pechiney

Compagnie de Produits Chimiques et Electrometallurgiques, Pechiney, has announced that aluminium deliveries last year totalled 257,000 tons compared with 217,000 tons in 1959. Domestic demand was so heavy that "Aluminium Français", a subsidiary, had to import 10,000 tons. Turnover of the chemical division rose by 27 per cent. Pechiney has declared an unchanged gross dividend of 4·75 new francs for 1960 on all shares including those issued in 1959. The company is to increase its capital by the issue of bonus shares in the ratio of one new share for every 20 old shares held. Net profit during the 1960 financial year is expected to be in the region of 34,000,000 new francs.

Referring to prospects for the current year, the chairman, M. Raoul de Vitry, said progress would be made due to increased aluminium and plastics production capacity. The company forecast the 1961 turnover would reach 1,100,000,000 new francs compared with 963,000,000 in 1960, which was a 22·5 per cent increase over 1959.

Wellman Smith Owen

It has been reported that Wellman Smith Owen Engineering Company's offer for the ordinary capital of Incandescent Heat Company Ltd. has been accepted as to 97·8 per cent of the ordinary stock and is now unconditional. It is understood that the offer remains open for the time being on the basis of the "wholly cash" alternative.

Charles Clifford Ltd.

Group net profit 1960 £73,002 (£65,654), and dividend 12 per cent (10 per cent). In December, 1959, holders also received 7½ per cent net capital distribution. Current assets £1,310,194 (£1,161,132), liabilities £396,680 (£303,914).

Revere Copper

Indicated fourth quarter sales and earnings of Revere Copper and Brass Incorporated (U.S.A.), and results in all 1960 were well below the similar 1959 periods, the firm reports. "The first quarter of 1961 is expected to show only slight improvement in volume of shipments over the last quarter of 1960", Mr. James M. Kennedy, chairman, and Mr. Charles A. Acife, President, said in the report. They added, however, that "we look for some pick-up in business in the last three-quarters of the year".

Revere's fourth quarter indicated sales were $47,171,600 and indicated net income $2,042,040. This compared with 1959 fourth quarter indicated sales of $59,060,813 and net of $2,408,148. For the year ended December 31, sales were $211,975,708 and net income $7,288,554 or $2·71 a share on 2,680,745 common shares outstanding. For 1959, sales were $245,786,790 and net income $10,066,185, or $3·77 a share on 2,668,950 common shares then outstanding.

The two executives said the decline in sales and earnings last year reflected the downward trend in the national economy, and the reduced demand for non-ferrous metal products in the automotive, electrical and building industries. This accounted for a 16 per cent overall drop in sales of brass industry products, the officials added. Another adverse factor, they said, "was the continued influx of competitive low-priced imports which, as in 1959, took 10 per cent of total United States business".

British Rollmakers Corpn.

Trading profits are up from £778,761 to £1,343,911, and net earnings from £429,936 to £737,402. Recommended dividend at 15 per cent and a one-for-four scrip issue. The directors point out that the scrip issue does not imply aggregate dividend payment for the current year.

New Companies

The particulars of companies recently registered are quoted from the daily register compiled by Jordan and Sons Limited, Company Registration Agents, Chancery Lane, W.C.2.

Slater Street Metals (Non-Ferrous) Limited (683943), 17 Slater Street, Liverpool. Registered February 20, 1961. Nominal capital, £1,000 in £1 shares. Directors: William J. Ahearne and Anna G. Ahearne.

Light Metal Statistics

Figures showing the U.K. production, etc., of light metals for Dec. 1960, have been issued by the Ministry of Supply as follows (in long tons):—

Virgin Aluminium	
Production	2,006
Imports	23,606
Despatches to consumers	22,788
Secondary Aluminium	
Production	9,911
Virgin content of above	1,002
Despatches (including virgin content)	9,839
Scrap	
Arisings	14,225
Estimated quantity of metal recoverable	10,350
Consumption by:	
(a) Secondary smelters	11,400
(b) Other uses	1,611
Despatches of wrought and cast products	
Sheet, strip and circles	14,121
Extrusions (excluding forging bar, wire-drawing rod and tube shell):	
(a) Bars and sections	4,246
(b) Tubes (i) extruded	251
(ii) cold drawn	590
(iii) formed strip	—
(c) (i) Wire	1,434
(ii) Hot rolled rod (not included in (c) (i)	54
Forgings	370
Castings: (a) Sand	1,590
(b) Gravity die	3,948
(c) Pressure die	1,995
Foil	2,313
Paste	283
Magnesium Fabrication	
Sheet and strip	16
Extrusions	122
Castings	172
Forgings	14

Scrap Metal Prices

The figures in brackets give the English equivalents in £1 per ton:—

France (new francs per kilo):

Electrolytic copper scrap	(£218.0.0)	2.95
Heavy copper	(£218.0.0)	2.95
No. 1 copper wire	(£203.4.0)	2.75
Brass rod ends	(£164.1.0)	2.22
Zinc castings	(£67.19.0)	0.92
Lead	(£65.0.0)	0.88
Aluminium	(£134.9.0)	1.82

Italy (lire per kilo):

Aluminium soft sheet clippings (new)	(£178.2.0)	305
Lead, soft, first quality	(£80.0.0)	137
Lead, battery plates	(£44.19.0)	77
Copper, first grade	(£214.2.0)	365
Bronze, commercial gunmetal	(£178.2.0)	305
Brass, heavy	(£148.18.0)	255
Brass, light	(£134.6.0)	230
Brass, bar turnings	(£148.18.0)	255
Old zinc	(£64.4.0)	110

Japan (Yen per metric ton):

Electrolytic copper	(£—)	283,000
Copper wire No. 1	(£—)	265,000
Copper wire No. 2	(£—)	250,000
Heavy copper	(£—)	250,000
Light copper	(£—)	215,000
Brass, new cuttings	(£—)	200,000
Red brass scrap	(£—)	212,000

West Germany (D-marks per 100 kilos):

Used copper wire	(£204.19.0)	225
Heavy copper	(£204.19.0)	225
Light copper	(£182.4.0)	200
Heavy brass	(£132.1.0)	145
Light brass	(£95.13.0)	105
Soft lead scrap	(£52.16.0)	58
Zinc scrap	(£52.16.0)	58
Used aluminium unsorted	(£81.19.0)	90

THE STOCK EXCHANGE

Market Continued To Provide Several Strong Features

ISSUED CAPITAL *	AMOUNT OF SHARE	NAME OF COMPANY	MIDDLE PRICE 27 MARCH +RISE—FALL	DIV. FOR LAST FIN. YEAR	DIV. FOR PREV. YEAR	DIV. YIELD	1961 HIGH	1961 LOW	1960 HIGH	1960 LOW
£	£			Per cent	Per cent					
4,435,792	1	Amalgamated Metal Corporation	32/6	11	9	6 15 6	32/6	26/3	35/-	26/6
400,000	2/-	Anti-Attrition Metal	1/-	NIL	4	NIL	1/-	0/9	1/6	0/9
43,133,593	Stk. (£1)	Associated Electrical Industries	46/-xd —6d.	15	15	6 10 6	54/10½	40/3	67/3	38/3
3,895,963	1	Birfield	56/- —3/-	10	15‡	3 11 6	55/7½	45/-	51/3	29/-
4,795,000	1	Birmid Industries	87/- +1/6	20	20D	4 12 0	87/3	71/3	74/9	56/-
8,445,516	Stk. (10/-)	Birmingham Small Arms	35/6 +1/-	17½QT	12½	3 7 0	35/7½	24/9	30/6	18/3
203,150	Stk. (£1)	Ditto Cum. A. Pref. 5%	14/6	5	5	6 18 0	14/4½	14/-	17/4½	14/9
476,420	Stk. (£1)	Ditto Cum. B. Pref. 6%	16/6	6	6	7 5 6	17/6	16/9	20/-	17/1½
500,000	1	Bolton (Thos.) & Sons	48/9	12½	10	4 6 6	48/9	37/6	43/-	36/-
300,000	1	Ditto Pref. 5%	14/3	5	5	7 0 3	14/6	13/9	16/-	14/3
1,500,000	Stk. (£1)	British Aluminium Co. Pref. 6%	17/-	6	6	7 1 3	18/-	16/6	21/1½	17/7½
18,846,647	Stk. (£1)	British Insulated Callender's Cables	57/- —9d.	13½	13½	4 14 9	58/6	50/4½	61/4½	47/-
20,456,599	5/-	British Oxygen Co. Ltd., Ord.	32/- —9d.	16	16	2 10 0	31/10½	26/3	35/-	19/10½
1,200,000	Stk. (5/-)	Canning (W.) & Co.	19/6 —1/-	15 - 8¾C	25 + *2¼C‡	3 17 0	20/-	13/7½	19/9	13/7½
60,484	1/-	Carr (Chas.)	1/4½	NIL	12½	—	1/6	1/-	2/3	1/-
555,000	1	Clifford (Chas.) Ltd.	29/-	12	10	8 5 6	29/-	26/-	35/-	28/9
45,000	1	Ditto Cum. Pref. 6%	15/3	6	6	7 17 6	15/3	15/1½	16/-	15/10½
300,000	2/-	Coley Metals	3/9	15	15	8 0 0	4/2½	3/6	5/-	3/4½
10,185,696	1	Cons. Zinc Corp.†	71/3 +1/9	20	15	5 12 3	72/-	64/-	80/9	59/6
5,399,056	1	Davy-Ashmore	177/6 +2/6	30‡	20	1 13 9	179/-	129/6	147/3	99/6
8,000,000	5/-	Delta Metal	24/4½ +4½d.	20	17½	4 2 0	25/4½	19/9	28/3	18/6
5,296,550	Stk. (£1)	Enfield Rolling Mills Ltd.	51/- —1/3	15	15	5 17 9	52/3	45/-	56/9	45/-
1,155,000	1	Evered & Co.	45/-	10B	10φ	2 19 6	45/-	42/6	42/9	29/3
18,000,000	Stk. (£1)	General Electric Co.	36/-	10	10	5 11 0	39/6	29/6	47/9	29/-
1,500,000	Stk. (10/-)	General Refractories Ltd.	59/- —9d.	25	20	4 4 9	59/9	42/9	52/6	40/-
937,500	5/-	Glacier Metal Co. Ltd.	17/6 +1/3	13	11½	4 2 3	17/9	13/9	16/1½	11/1½
2,500,000	5/-	Glynwed Tubes	28/3 +2/6	25¶	20	3 2 0	28/10½	23/7½	27/6	17/-
7,228,065	10/-	Goodlass Wall & Lead Industries	41/- +1/9	19L	16	3 10 9	41/9	34/9	41/9	33/-
696,780	10/-	Greenwood & Batley	25/6xcap +3d.	30W	30	5 17 9	27/-	23/9Z	33/6	29/1½
792,000	5/-	Harrison (B'ham) Ord.	13/3 —3d.	*20‡	*17½	3 15 6	13/6½	12/3	15/10½	11/9
150,000	1	Ditto Cum. Pref. 7%	20/-	7	7	7 0 0	20/3	20/-	23/6	22/-
1,612,750	5/-	Heenan Group	15/4½xd +4½d.	13	15	4 4 6	15/6	10/6	13/-	9/10½
251,689,407	Stk. (£1)	Imperial Chemical Industries	70/9 —6d.	13½	11½	3 17 3	71/10½	63/1½	76/6	54/-
34,736,773	Stk. (£1)	Ditto Cum. Pref. 5%	15/- —6d.	5	5	6 13 3	15/9	14/10½	18/-	15/4½
29,196,118	**	International Nickel	123½	$1.60	$1.50	2 7 0	126	104	105	84½
300,000	1	Johnson, Matthey & Co. Cum. Pref. 5%	14/6 +3d.	5	5	6 18 0	14/10½	14/-	16/6	14/6
6,000,000	1	Ditto Ord.	62/3 +1/-	12	12D	3 17 3	62/9	59/6	67/6	44/9
600,000	10/-	Keith, Blackman	21/-	17½	17½E	8 6 9	21/-	18/3	32/6	17/6
320,000	4/-	London Aluminium	10/9	12	10	4 9 3	10/10½	0/6	12/6	7/10½
765,012	1	McKechnie Bros. Ord.	56/3 +2/3	17½F	15F	6 4 6	56/9	53/6	71/6	57/3
1,530,024	1	Ditto A. Ord.	55/- +1/9	17½F	15F	6 7 3	55/9	53/3	69/3	55/-
1,108,268	5/-	Manganese Bronze & Brass	18/3	20‡	20‡	5 13 0	18/6	14/-	18/6	13/4½
50,628	6/	Ditto (7½% N.C. Pref.)	5/6	7½	7½	8 3 9	6/-	5/6	6/6	5/9
26,361,444	Stk. (£1)	Metal Box	87/6	12M	13B	2 9 6	88/3	69/3	84/3	61/-
415,760	Stk. (2/-)	Metal Traders	8/-	50	50	12 10 0	8/3	6/9	10/9	7/1½
160,000	1	Mint (The) Birmingham	37/6 +6d.	10	10	5 6 9	37/6	36/-	39/-	33/6
80,000	5	Ditto Pref. 6%	76/3	6	6	7 17 6	77/6	76/-	80/-	75/-
5,197,938	Stk. (£1)	Morgan Crucible A	62/6 +6d.	13	12	4 3 6	63/-	53/4½	63/-	47/6
1,000,000	Stk. (£1)	Ditto 5½% Cum. 1st Pref.	15/6	5½	5½	7 2 0	17/-	15/3	18/9	15/9
1,850,000	Stk. (£1)	Murex	45/9 +1/9	22½J	15	5 4 3	46/-	39/9	45/-	35/3
585,000	5/-	Ratcliffs (Great Bridge) Ord.	16/-	10	10R	3 2 6	16/6	16/-	17/-	14/9
195,000	5/-	Ditto 8% Max. Ord.	5/-	8	—	8 0 0	5/-	4/10½	5/3	5/-
1,064,880	10/-	Sanderson Kayser	37/3 —9d.	35‡	25	4 19 0	38/-	33/9	40/3	27/7½
3,400,500	Stk. (5/-)	Serck	17/9 +3d.	12½	17½GD	3 10 6	18/3	15/-	25/6	15/3
8,035,372	Stk. (£1)	Stone-Platt Industries	66/6	15	15	4 10 3	66/10½	55/-	64/4½	52/3
2,928,963	Stk. (£1)	Ditto 5½% Cum. Pref.	15/6 —3d.	5½	5½	7 2 0	15/9	15/-	18/7½	15/3
35,344,881	Stk. (£1)	Tube Investments Ord.	82/6 —2/-	14	20	3 8 0	84/6	72/3	140/3	63/10½
41,000,000	Stk. (£1)	Vickers	32/3 —1/-	10	10	6 4 0	33/3	28/-	39/7½	27/1½
750,000	Stk. (£1)	Ditto Pref. 5%	13/- —6d.	5	5	7 13 9	13/6	12/7½	17/6	13/3
6,863,807	Stk. (£1)	Ditto Pref. 5% tax free	20/- —3d.	*5	*5	7 8 9A	20/7½	19/9	24/6	20/1½
4,594,418	1	Ward (Thos. W.) Ord.	77/9 +2/3	13¾	25	3 10 9	77/9	64/6	94/-	63/-
7,109,424	Stk. (£1)	Westinghouse Brake	41/- —9d.	11	10	5 7 3	41/7½	36/4½	60/6	37/6
323,773	2/-	Wolverhampton Die-Casting	9/9 —3d.	35	30	7 3 6	10/2½	9/-	13/10½	8/1½
591,000	5/	Wolverhampton Metal	28/9	32½	27½	5 12 3	29/3	24/6	39/9	23/9
156,930	2/6	Wright, Bindley & Gell	3/10½ —1½d.	15	20‡	9 13 6	4/3	3/7½	4/3	2/10½
124,140	1	Ditto Cum. Pref. 6%	13/6	6	6	8 17 9	13/7½	13/6	15/-	13/6
150,000	1/-	Zinc Alloy Rust Proof	5/- +3d.	40	30	8 0 0	5/3	4/6	5/4½	4/-

*Dividend paid free of Income Tax. †Incorporating Zinc Corpn. & Imperial Smelting. **Shares of no Par Value. ‡ and 100% capitalized issue. *The figures given relate to the issue quoted in the third column. A Calculated on £7 8 9 gross. D and 50% capitalized issue. C paid out of Capital Profits. E and 50% capitalized issue in 7% 2nd Pref. Shares. R and 33⅓% capitalized issue in 8% Maximum Ordinary 5/- Stock Units. φ and 6¼% from Capital Profits. B and 50% capitalized issue. G and 1½d special distribution. F and special 5% tax free dividend. H As forecast. ¶And 3 for 7 capitalized issue. L and 33⅓% capitalized issue. M and 10% capitalized issue. J and 75% capitalized issue. S and 40% capitalized issue. O calculated at 13⅓%. Interim on smaller capital. P Calculated at 11¼%. Q also 1/- special tax free dividend and 50% capitalized issue. T Per £1 unit. W Before capital reorganization. Calculated at 15%. Z After capital reorganization.

D

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